

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 30 Years Successfully
INSTITUTION WITH UGC 12B STATUS

M.Tech.

COMPUTER INTEGRATED MANUFACTURING

Curriculum and Syllabus
Regulations 2021

(Based on Choice Based Credit System (CBCS))

Effective from the Academic year
2021-2022

Department of Mechanical Engineering
School of Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

The Department of Mechanical Engineering envisages to be recognized as a role model in advanced fields of Mechanical Engineering Education and Research and to cater the ever-changing industrial demands and social needs.

Mission of the Department

M1: Educate, motivate and prepare the students to know the fundamental and technical skills in Mechanical Engineering through effective teaching learning Methodologies.

M2: To imbibe professional and ethical standards in the minds of the young engineers by continuous learning and professional activities.

M3: To impart the employability skills to the students as industry ready by implant training and industrial visits.

M4: To create entrepreneurship skills by industrial collaborations and mentoring.

M5: To encourage students to undertake R&D activities for the societal needs with high ethical standards.

PROGRAMME OUTCOMES:

PO 1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO 2: An ability to write and present a substantial technical reports/documents.

PO 3: Students should be able to design and develop the component at the mastery over the area of the CAD/CAM Environment and they meet requirements in the computer integrated manufacturing environment.

PO 4: Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

PO 5: Graduate will show the understanding of impact of engineering solutions on the society with professional and ethical responsibilities and also will be aware of contemporary issues.

Programme Educational Objectives (PEO's)

The Graduates will be Mechanical Engineering related technical and aptitude skills to offer best solution to industrial and societal problems.

PEO 1: To impart the fundamental and the latest technological knowledge to students in the topics on Computer Aided Design, Computer Aided Manufacturing and Computer Aided Engineering Analysis.

PEO 2: To broaden and deepen their capabilities in analytical and experimental research methods, analysis of data, and drawing relevant conclusions for scholarly writing and presentation.

PEO 3: To create the knowledge on Computer Integrated Manufacturing environmental and Learn about the importance of data generation management in CIMS.

PEO 4: To develop the broad knowledge to the students in learning steps in upgrading from Flexible Manufacturing System (FMS) to Computer Integrated Manufacturing (CIM) environment.

PEO 5: To create a congenial environment that promotes learning, growth and imparts ability to work with interdisciplinary groups in professional, industry and research organizations.

Program Specific Outcomes (PSOs)

PSO 1	The graduate will be able to design subsystems of Computer Integrated Manufacturing systems by integrating automation with mechanical systems in manufacturing, assembly and testing.
PSO 2	Graduate will be able to develop advanced tools for evaluating performance of automated systems and for data automation with respect to materials, machine and other resources.

BOARD OF STUDIES

The details of the suggested Board of Studies (BOS) Members for the Department of Mechanical Engineering are shown below.

S. No	Name of the Board Member	Designation	Institute / Industry
INTERNAL MEMBERS			
1	**Dr. M. Chandrasekaran**	Director, Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
2	**Dr. C. Dhanasekaran**	Engineering Coordinator & Head of the Department, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
3	**Dr. V. Muthuraman**	Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
4	**Dr. R. Pugazhenthi**	Associate Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
5	**Dr. S. Sivaganesan**	Associate Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
EXTERNAL EXPERT MEMBERS			
1	**Dr. V. Santhanam**	Associate Professor, Department of Mechanical Engineering	Rajalakshmi Engineering College, Chennai, Tamilnadu.
2	**Mr. S. Dwarakanathan**	Vice President (Retd.)	Brakes India Limited, Chennai, Tamilnadu.
3	**Mr. V. Venkatesh**	Unit Head	Suprajit Engineering Limited, Sriperumbadur, Chennai, Tamilnadu.

M.E. – COMPUTER INTEGRATED MANUFACTURING

CURRICULUM

(MINIMUM CREDITS TO BE EARNED: 80)

Category	Course Title	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER I								
21CMCI11	Mathematical Optimization	3	1	0	4	40	60	100
21CMCI12	Flexible Competitive Manufacturing System	3	1	0	3	40	60	100
21DMCI11	Applied Materials Engineering	3	1	0	4	40	60	100
21DMCI12	Advances in Metrology and Testing	3	1	0	4	40	60	100
21PMCI11	Computer Aided Design and Analysis Laboratory	0	0	4	2	40	60	100
21SMCI11	Technical Seminar	0	0	4	2	40	60	100
21MCCI11	Research Methodology and IPR	2	0	0	2	40	60	100
Audit Course	Audit Course - 1	2	0	0	0	40	60	100
		16	**0**	**8**	**21**			

Category	Course Title	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER II								
21CMCI21	Computer Aided Design and Manufacturing	3	1	0	4	40	60	100
21CMCI22	Production and Operations Management	3	1	0	4	40	60	100
21DMCI21	Professional Elective Course - III	3	1	0	4	40	60	100
21DMCI22	Professional Elective Course - IV	3	1	0	4	40	60	100
21PMCI21	Computer Integrated Manufacturing LAB	0	0	4	2	40	60	100
21PMCI22	Simulation and Optimization Programming LAB	0	0	4	2	40	60	100
21PMCI23	Mini Project	0	0	4	2	40	60	100
21MSUD21	Audit Course – 2	0	0	0	1	40	60	100
		14	**0**	**12**	**23**			

Category	Course Title	Hours/Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER III								
21DMCI31	Professional Elective Course - V	3	1	0	4	40	60	100
21DMCI32	Open Elective	3	1	0	4	40	60	100
21IMCI31	Internship	0	0	4	2	40	60	100
21DMCI31	Dissertation – I	0	0	20	10	40	60	100
		6	**2**	**20**	**20**			

Category	Course Title	Hours/Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER IV								
21RMCI41	Dissertation – II	0	0	32	16	40	60	100
		0	**0**	**32**	**16**			

M.Tech. - COMPUTER INTEGRATED MANUFACTURING

CURRICULUM

LIST OF PROFESSIONAL CORE COURSES (PCC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MEI101	Mathematical Optimization	3	0	0	4
21MEI102	Flexible Competitive Manufacturing System	3	0	0	4
21MEI103	Computer Aided Design and Analysis Laboratory	3	0	4	2
21MEI104	Technical Seminar	0	0	4	2
21MEI105	Research Methodology and IPR	2	0	0	2
21MEI201	Computer Aided Design and Manufacturing	3	0	0	4
21MEI202	Production and Operations Management	3	0	0	4
21MEI203	Computer Integrated Manufacturing LAB	0	0	4	2
21MEI204	Simulation and Optimization Programming LAB	0	0	4	2
11RMCI21	Mini Project	0	0	4	2
21RMCI31	Dissertation – I	0	0	20	10
21RMCI41	Dissertation – II	0	0	32	16

LIST OF PROFESSIONAL ELECTIVE COURSES (PEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MEI101	Applied Materials Engineering	3	0	0	4
21MEI102	Advances in Metrology and Testing	3	0	0	4
21MEI103	Computer Aided Process Planning	3	0	0	4
21MEI104	Computer Applications in Manufacturing	3	0	0	4
21MEI105	Design of Hydraulic and Pneumatic	3	0	0	4
21MEI106	Mechatronics in Manufacturing Systems	3	0	0	4
21MEI107	Robotics and Sensors	3	0	0	4
21MEI108	Manufacturing System Simulation	3	0	0	4
21MEI109	Machine Vision and its Applications	3	0	0	4
21MEI110	Metal Forming Technology	3	0	0	4
21MEI111	Newer Welding and Casting Processes	3	0	0	4
21MEI112	Design of Cellular Manufacturing System	3	0	0	4
21MEI113	Instrumentation and Experimental Techniques	3	0	0	4
21MEI114	Internet of Things for Manufacturing	3	0	0	4
21MEI115	Flexible Manufacturing Systems	3	0	0	4
21MEI116	Sensors for Manufacturing and Condition Monitoring	3	0	0	4
21MEI117	Industrial Robotics	3	0	0	4
21MEI118	Rapid Prototyping and Tooling	3	0	0	4

LIST OF OPEN ELECTIVE COURSES (OEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21CMCI11	Total Quality System and Engineering	3	0	0	4
21CMCI12	Manufacturing Information Systems	3	0	0	4
21CMCI21	Supply Chain Management	3	0	0	4
21CMCI22	Reliability and Total Productive Maintenance	3	0	0	4
21CMCI31	Information Systems Analysis and Design	3	0	0	4
21CMCI32	Productivity Management and Re-Engineering	3	0	0	4

LIST OF AUDIT COURSES (AC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MSUD11	Constitution of India	2	0	0	0
21MSUD12	Pedagogy Studies	2	0	0	0
21MSUD13	Disaster Management	2	0	0	0
21MSUD21	Safety Management	2	0	0	0
21MSUD22	Stress Management by Yoga	2	0	0	0
21MSUD23	Value Education	2	0	0	0

SYLLABUS OF PROFESSIONAL CORE COURSES

21CMCI11 MATHEMATICAL OPTIMIZATION

L	T	P	C
3	1	0	4

COURSE OBJECTIVE:

1. To understand the optimization techniques used in compiler design.
2. To be aware of the various computer architectures that support parallelism.
3. To become familiar with the theoretical background needed for code optimization.
4. To understand the techniques used for identifying parallelism in a sequential program.
5. To learn the various optimization.

UNIT I LINEAR PROGRAMMING 9

Formulation- Assumption of liner programming**-**linear programming model, terminology for solution of the model- Graphical and simplex methods-Big-M method-Two phase method-Dual simplex method-Primal Dual problems.

UNIT II UNCONSTRAINED ONE DIMENSIONAL OPTIMIZATION TECHNIQUES 9

Necessary and sufficient conditions –Unrestricted search methods-Fibonacci and golden section method-Quadratic Interpolation methods, cubic interpolation and direct root methods.

UNIT III UNCONSTRAINED N DIMENSIONAL OPTIMIZATION TECHNIQUES 9

Direct search methods –Random search –pattern search and Rosen brooch's hill claiming method-Descent methods-Steepest descent, conjugate gradient, quasi -Newton method.

UNIT IV CONSTRAINED OPTIMIZATION TECHNIQUES 9

Necessary and sufficient conditions –Equality and inequality constraints-Kuhn-Tucker conditions-Gradient projection method-cutting plane method- penalty function method.

UNIT V DYNAMIC PROGRAMMING 9

Principle of optimality- recursive equation approach-application to shortest route, Backward-Moving Solution Procedure, Forward-Moving Solution Procedure cargo-loading, allocation and production schedule problems.

TOTAL 45 Hours

COURSE OUTCOMES:

After successful completion of Optimization Techniques course, the student will be able to

CO 1. Understand the basic theoretical principles in optimization and formulation of optimization models

CO 2. Apply basic concepts of mathematics to formulate an optimization problem.

CO 3. Acquire an idea about the various direct and indirect search methods.

CO 4. Visualize advanced optimization applications in Mechanical engineering.

CO 5. Analyse and appreciate variety of performance measures for various optimization problems.

TEXT BOOK:

1. Singiresu S. Rao, “Engineering Optimization Theory and Practice”, JOHN WILEY & SONS, INC.,2009

REFERENCES:

1. Rao, S.S.,”Optimization :Theory and Application” Wiley Eastern Press, 1978.
2. Taha, H.A., Operations Research –An Introduction, Prentice Hall of India.
3. Fox, R.L., ’Optimization methods for Engineering Design’, Addition Welsey, 1971.

WEB RESOURCE:

1. https://www.coursera.org/lecture/machine-learning/advanced-optimization-licwf
2. https://www.youtube.com/watch?v=rDRZU3eEuLU
3. https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L4slides.pdf

21CMCI12 FLEXIBLE COMPETITIVE MANUFACTURING SYSTEM

L	T	P	C
3	1	0	4

COURSE OBJECTIVE:

The course serves as an introduction to the modern methods of manufacturing. Its objectives are:

1. To expose the student to the different types of manufacturing available today such as the Special
2. Manufacturing System, the Manufacturing Cell, and the Flexible Manufacturing System (FMS),
3. To learn the fundamentals of computer assisted numerical control programming and programming languages
4. Automated flow lines,
5. The common CAD/CAM data base organized to serve both design and manufacturing, and
6. To practice the PLC control devices and CNC operation skills

UNIT I MANUFACTURING SYSTEMS & CONTROL 9

Automated Manufacturing Systems - Modelling - Role of performance modelling -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 networks - Factory net works - Open systems interconnection model - Net work to network interconnections - Manufacturing automation protocol - Database management system.

UNIT II MANUFACTURING PROCESSES 9

Examples of stochastic 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 instates - 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 MODELS 9

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 9

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 PETRI NETS 9

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

TOTAL 45 Hours

COURSE OUTCOMES:

After successful completion of Flexible Competitive Manufacturing System course, the student will be able to

CO 1. Understand the modern methods of manufacturing.

CO 2. Apply the concepts of PPC and GT to the development of FMS.

CO 3. Discuss the planning and scheduling methods used in manufacturing systems.

CO 4. Identify different types of manufacturing available today; such as the Special Manufacturing. System, the Manufacturing Cell, and the Flexible Manufacturing System (FMS), etc.

CO 5. Know the fundamentals of computer assisted numerical control programming and programming languages.

TEXT BOOK:

1. 1. Groover M.P., " Automation, Production Systems and Computer Integrated Manufacturing ", Third Edition, Prentice-Hall, 2007.

2. Jha, N.K. “Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.

REFERENCES:

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

2. Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, New Jersey, 1982.

3. Gupta S.C., & Kapoor V.K., "Fundamentals of Mathematical Statistics", 3rd Edition, Sultan Chand and Sons, New Delhi, 1988.

21PMCI11 COMPUTER AIDED DESIGN AND ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of analysis tools.

LIST OF EXPERIMENTS

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Thermal stress analysis of a 2D component
6. Conductive heat transfer analysis of a 2D component
7. Convective heat transfer analysis of a 3D component
8. Design and analysis the 3D Model of Fork with stress analysis
9. Design and analysis the 3D Model of Coupling with stress analysis
10. Design and analysis the 3D Model of Bearing with Thermal analysis

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

Computer System 18" VGA Color Monitor i3 Processor, 5000 GB HDD, 4 GB RAM	30
Color Desk Jet Printer	01

COURSE OUTCOMES:

After successful completion of the Computer Aided Analysis Laboratory course, the student will be able to

CO1: Explain the various basic analysis boundary conditions and components of element system.

CO2: Carry out mechanism simulation using Multibody Dynamic software.

CO3: Solve stress analysis problems of link elements in Trusses, cables, beams, flat plates, simple shells and axi–symmetric components.

CO4: Solve thermal stress and heat transfer analysis of plates, cylindrical shells.

CO5: Examine the model analysis of beams and harmonic, transient and spectrum analysis of simple systems.

21SMCI11 TECHNICAL SEMINAR

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

- To identify a specific topic/ area/ problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To train the students in preparing reports and to face reviews and examination for the first semester.

SYLLABUS:

The student individually select a specific topic approved by the head of the division under the guidance of a faculty member of the particular subject or who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners of the same department.

COURSE OUTCOMES:

After successful completion of Seminar I, the student will be able to

CO 1: The Seminar engages students in the integrated activities of reading, research, discussion, and composition around a modern manufacturing environment.

CO 2: Students will gain a deeper appreciation of the role of writing in scholarly investigation, as they refine, adapt, and expand their abilities to absorb, synthesize and construct arguments in close-knit community.

CO 3: To expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions.

CO 4: To set the stage for future recruitment by potential engineer.

CO 5: Students will demonstrate the ability to prepare appropriately to participate effectively in class discussion.

21MCCI11 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

COURSE OBJECTIVE:

1. To Understand research problem formulation and analyze research related information with research ethics.
2. To Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

UNIT I INTRODUCTION TO RESEARCH 7

The hallmarks of scientific research – Building blocks of science in research – Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.

UNIT II EXPERIMENTAL DESIGN 7

Laboratory and the Field Experiment – Internal and External Validity – Factors affecting Internal validity. Measurement of variables – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures

UNIT III DATA COLLECTION METHODS 7

Interviewing, Questionnaires, etc. Secondary sources of data collection. Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys. Special Data Sources: Focus Groups, Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-Collection Methods and their utility. Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Determination of Optimal sample size

UNIT IV DATA ANALYSIS AND RESEARCH REPORT 7

Data Analysis – Factor Analysis – Cluster Analysis – Discriminant Analysis – Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a report, Table of contents, Abstract, Synopsis, Introduction, Body of a report – Experimental, Results and Discussion – Recommendations and Implementation section – Conclusions and Scope for future work.

UNIT V INTELLECTUAL PROPERTY RIGHTS 7

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 35 Hours

COURSE OUTCOMES:

After successful completion of Research Methodology and IPR course, the student will be able to

CO 1: Understand research problem formulation.

CO 2: Analyze research related information and Follow research ethics

CO 3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO 4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO 5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

REFERENCES:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall , "Industrial Design", McGraw Hill, 1992.
4. Niebel , "Product Design", McGraw Hill, 1974.
5. Asimov , "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

21CMCI21 COMPUTER AIDED DESIGN AND MANUFACTURING

L	T	P	C
3	1	0	4

COURSE OBJECTIVE:

- On completion of the course the students are expected to be knowledgeable in 2 dimensional and 3 dimensional transformations, modeling and analysis, CAD/CAM integration, CNC machine tool building, CNC programming using manual method and generation of CNC codes using CAM software.

UNIT-I TWO DIMENSIONAL AND THREE DIMENSIONAL TRANSFORMATIONS 8

2D – Representation and Transformations of points – Transformations of Lines – Rotation, Reflection, Scaling and combined transformations, 3D – Scaling – Shearing– Rotation- Reflection – Translation – Projections parametric representation of Ellipse, parabola, Hyperbola- Practice on sate of the art CAD software.

UNIT – II MODELLING AND ANALYSIS 8

Wire frame, surface and solid modeling – solid modeling packages – Finite Element analysis (FEA) – Introduction and procedures – solution Techniques – Introduction to FEA packages.

UNIT – III CAD/CAM INTEGRATION 9

Networking- networking techniques, LAN, components, wiring methods, network interface cards, network standards, Graphics standards – Data exchange format, evolution- features of various interfaces GKS, IGES, DXF, PDES, STEP etc., Process planning, Computer Aided process planning(CAPP) - variant, generative approaches

UNIT – IV COMPUTER NUMERICAL CONTROL MACHINES 10

CNC Machine Building, structural details – configuration and design, friction and anti friction LM guide ways, Ball screw, torque transmission elements, Spindle drives, Feed drives, Positional measuring transducers- gratings, encoders, induction, laser interferometer, Spindle, ATC, APC, Tooling – qualified, preset tooling.

UNIT – IV CNC PROGRAMMING 10

Structure of CNC program, Coordinate system, G & M codes, cutter radius compensation, tool nose radius compensation, tool wear compensation, canned cycles, sub routines, do loop, mirroring features, Manual part programming for CNC turning and machining centre,Generation of CNC program using popular CAM software.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Computer Aided Design and Manufacturing course, the student will be able to

CO 1: Understand 2 dimensional and 3 dimensional transformations, modeling and analysis and CAD/CAM integration.

CO 2: Use basic and advanced features of current CAD software.

CO 3: Understand how CAD technology can be leveraged in the design process

CO 4: Design a part or assembly of parts using Computer-Aided Design software.

CO 5: Apply top-down design principles to model a design.

TEXT BOOKS:

1. P N Rao, “CAD/CAM: Principles and Applications”, Tata McGraw –Hill Ed., 2004.

2. Groover M.P., Automation, “Production Systems and Computer Integrated Manufacturing”, Prentice-Hall of India Pvt.Ltd, New Delhi, 1996.

REFERENCES:

1. David F.Rogers and Alan Adams.J, “Mathematical Elements for Computer Graphics”, McGraw –Hill Publishing Company International Edition, 1990.

2. Sadhu Singh, :Computer Aided Design and Manufacturing”, Khanna publications,2000

3. Warren S Seames,Computer Numerical Control Concepts and Programming, Thomson Delmar, fourth Edition, 2002

4. Ibrahim Zeid, “Mastering CAD/CAM”, Tata McGraw –Hill Ed., 2007

5. HMT, “Mechatronics”, Tata McGraw –Hill Ed., 1998

6 P Radhakrishnan, S Subramanyan, “CAD/CAM/CIM”, New Age Publishers, 1994.

21CMCI22 PRODUCTION AND OPERATIONS MANAGEMENT

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To impart knowledge on Manufacturing strategies and compositeness, Designing of Products, facilities and jobs, Inventory systems, MRP and revising the systems.

UNIT I FORECASTING AND FACTORY LAYOUT 9

Introduction, measures of forecast, accuracy, forecasting methods - time series smoothing - regression models - exponential smoothing - seasonal forecasting – cyclic forecasting. Location factors, location evaluation methods, different types of layouts for operations and production, arrangement of facilities within departments.

UNIT II INVENTORY ANALYSIS AND CONTROL 9

Definitions - ABC inventory system - EOQ models for purchased parts - inventory order policies - EMQ models for manufactured parts - lot sizing techniques, inventory models under uncertainty.

UNIT III JUST IN TIME AND SCHEDULING 9

Elements of JIT - uniform production rate - pull versus push method - Kanban system - small lot size - quick, inexpensive set-up - continuous improvement, optimized production technology. Objectives in scheduling - major steps involved -information system linkages in production planning and control - production control in repetitive, batch and job-shop manufacturing environment.

UNIT IV AGGREGATE PLANNING AND PROJECT PLANNING 9

Approaches to aggregate planning - graphical, empirical, and optimization, development of a master production schedule, materials requirement planning (MRP- I) and manufacturing resource planning (MRP -II), ERP. Evolution of network planning techniques - CPM – PERT- Network stochastic consideration, project monitoring, line of balance.

UNIT V SCHEDULING WITH RESOURCE CONSTRAINTS 9

Allocation of units for a single resource - allocation of multiple resources - resource balancing, line balancing - helgeson brine approach - region approach, stochastic mixed - product line balancing, flexible manufacturing system - concepts - advantages and limitation - computer integration and AI in manufacturing and operations, electronic data interchange.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Production and Operations Management course, the student will be able to

CO 1: Understand the role of operations management in the overall business strategy of the firm.

CO 2: Explain the major concepts in the functional areas of accounting, marketing, finance, and management.

CO 3: Evaluate the legal, social, and economic environments of business.

CO 4: Apply decision-support tools to business decision making.

CO 5: Construct and present effective oral and written forms of professional communication.

TEXT BOOKS:

1. Panneerselvam R., “Production and Operations Management”, Prentice-Hall of India Pvt.Ltd., New Delhi, 2002.
2. Elwood S Buffa, Rakesh K Sarin, “Modern Production and Operations Management”, JohnWiley & Sons Inc, 2002.

REFERENCES:

1. Thomas E Vollmann, William I Berry, "Manufacturing Planning and Control Systems", Galgotia Publication (P) Ltd., New Delhi, 2003.
2. Everette E Adam, Ronald J Ebert, “Production and Operations Management: Concepts Models and Behavior”, Prentice Hall, Inc., 2002.
3. James D Dilworth, "Production and Operations Management ", Tata McGraw Hill, Inc, New Delhi, 1993.

4 Bedworth D.D., "Integrated Production Control Systems Management, Analysis, Design", John Wiley & Sons, New York, 1982.

		L	T	P	C
21PMCI21	**COMPUTER INTEGRATED MANUFACTURING LAB**	**0**	**0**	**4**	**2**

COURSE OBJECTIVE:

- To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's and to impart knowledge on the use of Finite Element Analysis software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Nonlinear analysis (Exercise must include plastic deformation of simple objects or crash analysis simple structures.
4. 3 Axis CNC code generations for CNC machining.
5. CNC Machining of complex features like machining of hemisphericpal cavity, tapered hole, hole of parabolic shape etc.

LIST OF EQUIPMENTS REQUIRED:

1. Computers 18
2. CAD Workstation
3. FEA Software
4. CAM Software for 3 axis machining or more
5. CNC Production type lathe or Milling Machine

COURSE OUTCOMES:

After successful completion of Computer Integrated Manufacturing lab, the student will be able to

CO 1: Impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's.

CO 2: To impart knowledge on the use of Finite Element Analysis software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

CO 3: Identify the main elements in computer integrated manufacturing systems; Apply knowledge of computer aided process planning, feature and group technology, and data exchange in manufacturing processes.

CO 4: Apply the concepts/components of computer integrated manufacturing and integrate them in a coordinated fashion;

CO 5: Process product models with CAM tools and CNC machines.

21PMCI22 SIMULATION AND OPTIMIZATION PROGRAMMING LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To be familiar with the MATLAB GUI and basic tool boxes
- To be exposed to vector and matrix operations
- To be familiar with arithmetic, logical and relational operations on matrix

LIST OF EXPERIMENTS:

1. Introduction to SDK of MATLAB
2. Basic Syntax and scalar arithmetic operations and calculations
3. Working with formulas
4. Arithmetic operations in matrix data
5. Matrix operations (Inverse, Transpose)
6. Reading an image file
7. Reading from and writing to a text file
8. Introduction to toolboxes
9. Data visualization and plotting
10. Relational operators in data
11. Logical operation in data
12. Loops in MATLAB
13. Computing Eigen value for a matrix
14. Random number generation - Montecarlo methods

TOTAL: 40 PERIODS

COURSE OUTCOMES:

After successful completion of the Simulation and Optimization Programming LAB course, the student will be able to

CO 1: Understanding of MATLAB environment

CO 2: Perform data handling in MATLAB environment

CO 3: Solve simple matrix problems

CO 4: Write simple program

CO 5: Use built-in toolboxes

REFERENCES:

1. Holly Moore, " MATLAB for Engineers" Third Edition – Pearson Publications
2. Stephen J. Chapman, "MATLAB Programming for Engineers" Fourth Edition – Thomson learning.

21PMCI23 MINI PROJECT

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Dicovering potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

SYLLABUS:

A project topic must be selected by the student individually in consultation with their guides. The ultimate aim of the project work is to deepen comprehension of mechanical principles by applying them to a new problem which may be the design and develop of a device for a specific application.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of Mini Project, the student will be able to

CO 1: Discover potential research areas in the field of Mechanical Engineering.

CO 2: Compare and contrast the several existing solutions for the problems identified.

CO 3: Formulate and propose a plan for creating a solution for the research plan identified.

CO 4: Conduct the experiments as a team and interpret the results.

CO 5: Report and present the findings of the work conducted.

21RMCI31 DISSERTATION – I

L	T	P	C
0	0	20	10

COURSE OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:

The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 Hours

COURSE OUTCOMES:

After successful completion of Project Work – Phase I, the student will be able to

CO 1: Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.

CO 2: Develop the methodology to solve the identified problem.

CO 3: Train the students in preparing project reports and to face reviews and viva-voce examination.

CO 4: Get clear idea about the project work and they are in a position to carry out the remaining phase II work in a systematic way.

CO 5: Able to identify one's need for further knowledge and continuously develop one's own competencies.

21RMCI41 DISSERTATION – II

L	T	P	C
0	0	32	16

COURSE OBJECTIVES:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner

TOTAL: 360 Hours

COURSE OUTCOMES:

After successful completion of Project Work – Phase II, the student will be able to

CO 1: Continue the phase I work on the selected topic as per the formulated methodology under the same supervisor.

CO 2: The identified problem based on the formulated methodology.

CO 3: Develop skills to analyze and discuss the test results, and make conclusions.

CO 4: On completion of the project work student will be in a position to take up any challenging practical problems in the field of construction engineering and management and find better solutions to it.

CO 5: Ability to evaluate, and critically assess one's own and others' results.

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SYLLABUS OF PROFESSIONAL ELECTIVE COURSES

21MEI101 APPLIED MATERIALS ENGINEERING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- This course provides knowledge in the areas of Industrial metallurgy, advanced materials and selection of materials for industrial applications.

UNIT I PLASTIC BEHAVIOUR & STRENGTHENING 8

Mechanism of Plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals –Strengthening mechanism, work, hardening, solid solutioning, grain boundary strengthening, Poly phase mixture, precipitation, particle fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity.

UNIT II FRACTURE BEHAVIOUR 8

Griffith'stheory stress intensity factor and fracturetoughness-Toughening mechanisms – Ductile, brittle transition in steel-High temperature fracture, creep – Larson-Miller, Parameter – Deformation and fracture mechanism maps – Fatigue. Low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law – Effect of surface and metallurgical parameters on fatigue – fracture of non- metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 8

Motivation for selection, cost basis and service requirements – selection for Mechanical properties, strength, toughness, fatigue and creep – Selectionfor 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 IV MATERIAL PROCESSING 9

Processing of engineering materials – Primary and Secondary processes – astability, Weldability, forgeability and malleability Criteria – Process induced defects – Monitoring and control.

UNIT V MODERN MATERIALS AND TREATMENT 12

Dual phase steels, high strength low alloy (HSLA) Steel transformation included plasticity (TRIP), Steel, maraging steel, shape memory alloys, properties applications of engineering plastics and composites materials advanced structural ceramics – WC, Tic, Tac, Al_2O_3, Sic, Si_3N_4, CBN diamond, heat treatment alloy and tool steels, vapour deposition – Plasma, PVD- thick and thin film deposition – Nano materials- production of Nano sized materials.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Applied Materials Engineering course, the student will be able to

CO 1: Apply core concepts in Materials Science to solve engineering problems.

CO 2: Understand the professional and ethical responsibilities of a materials scientist and engineer.

CO 3: Classify different mechanical properties and how they can influence the materials behavior with respect to applied load.

CO 4: Know the principles of metallurgical microscope, X-ray Diffractrometer (XRD), scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Thermal analysis and dilatometer.

CO 5: Determine the crystal structure, lattice parameter, surface topography using different methods.

TEXT BOOKS:

1. Courtney, T.H., “Mechanical Behavior of Materials” ,(2nd edition), McGraw Hill, 2000.
2. Dieter, G.E., “Mechanical Metallurgy”, McGraw Hill, 1988.

REFERENCES:

3. The Hand book of Advance Materials, James k.Wessel, Wiley, Intersam, john, Wilson Publishers., 2004.
4. Surface Engineering of Materials- Principles of EquipmeTechniques ,Tadensz.
5. Burakonsa &T.Wierzchan. Thoas h.Courtney, “Mechanical Behaviour of Materials”,(second edition), McGraw Hill, 2000.
6. Flinn,R.A.and Trojan ,P.K.., “Engg Meterials and their Application (fourthEdition), Jaico, 1999.
7. Metals hand book , vol. 10, “Failure Analysis and Prevention” ,(tenth edition) 1994.
8. George E.Dieter, “Mechanical Metallurgy”, McGraw Hill, 1988.
9. Charles, J.A., Crane, F.A.A and Furness, J.A.G., “Selection and use of Engineering Materials”, (third Edition), Butterworth – Heiremann, 1977.

21MEI102 ADVANCES IN METROLOGY AND TESTING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To educate students with the NDT methods include ultrasonic, magnetic-particle, liquid penetrant, radiographic, remote visual inspection (RVI).

UNIT I MEASURING MACHINES **9**

Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine - Laser viewers for production profile checks - Image shearing microscope - Use of computers - Machine vision technology - Microprocessors in metrology.

UNIT II STATISTICAL QUALITY CONTROL **9**

Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits -Control charts for variables and for fraction defectives - Theory of probability - Sampling - ABC standard - Reliability and life testing.

UNIT III LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS **9**

Characteristics of liquid penetrants - different washable systems - Developers - applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

UNIT IV RADIO GRAPHY **9**

Sources of ray-x-ray production - properties of d and x rays - Film Radiography- film characteristics - use of film, characteristic curves (H & D curve) - latent image formation on film - radiographic exposure, reciprocity law, photographic density exposure charts - contrasts - operational characteristics of x ray equipment - Radiographic Image Quality and Radiographic Techniques- applications.

UNIT V ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES **9**

Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method - A, B, C scans - Principles of acoustic emission techniques - Advantages and limitations - Instrumentation - applications.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Metrology and Non Destructive Testing course, the student will be able to

CO 1: Knowledge of surface NDE techniques; which enables to carry out various inspections in accordance with the established procedures.

CO 2: Differentiate various defect types and select the appropriate NDT methods for better evaluation.

CO 3: Ability to communicate their conclusions clearly to specialist and non-specialist audiences.

CO 4: Understand the eddy current instrument and perform inspection of weldments with unknown

defects.

CO 5: Provide knowledge and enrich ideas about the conventional NDT techniques and develop to inspecting and evaluating components in accordance with industry specifications.

Text Books:

1. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
2. Bewoor, A.K. and Kulkarni,V.A.,”Metrology and Measurement”, Tata Mc Graw-Hill, 2009.

REFERENCES:

1. JAIN, R.K. " Engineering Metrology ", Khanna Publishers, 1997.

2. Barry Hull and Vernon John, " Non Destructive Testing ", MacMillan, 1988.

3. American Society for Metals, " Metals Hand Book ", Vol.II, 1976.

4. Progress in Acoustic Emission, " Proceedings of 10th International Acoustic Emission Symposium ", Japanese Society for NDI, 1990.

21DMCI22 COMPUTER AIDED PROCESS PLANNING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To familiarize the students with process planning in the manufacturing cycle, design, drafting, geometric modeling, systems in CAPP and report generation.

UNIT I INTRODUCTION 9

The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology.

UNIT II PART DESIGN REPRESENTATION 9

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure - Geometric modelling for process planning - GT coding - The OPTIZ system - The MICLASS system.

UNIT III PROCESS ENGINEERING AND PROCESS PLANNING 9

Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, Al.

UNIT IV COMPUTER AIDED PROCESS PLANNING SYSTEMS 9

Logical Design of a Process Planning - Implementation considerations - manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT V AN INTERGRADED PROCESS PLANNING SYSTEMS 9

Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Computer Aided Process Planning course, the student will be able to

CO 1: Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation.

CO 2: Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances.

CO 3: Explain the generation of tool path and solve optimization models of machining processes.

CO 4: Create awareness about the implementation techniques for CAPP

CO 5: Understand about group technology, computer aided process planning, material requirement planning (MRP) Enterprise resource planning (ERP), Computer aided quality control and Flexible manufacturing systems, Artificial intelligence and Expert systems.

TEXT BOOKS:

1. Halevi, G. and Weill, R.D., “Principles of Process Planning”, A logical approach – Springer, 2003.
2. Rao., “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Co. 2002.

REFERENCES:

1. Gideon Halevi and Roland D. Weill, "Principles of Process Planning ", A logical approach, Chapman & Hall, 1995.
2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.
3. Chang, T.C., "An Expert Process Planning System ", Prentice Hall, 1985.
4. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
5. Rao, “Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.

21MEI104 COMPUTER APPLICATIONS IN MANUFACTURING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- On completion of the course the students are expected to be knowledgeable in Engineering product specification, CAD/CAM integration, CNC machine tool building, CNC programming using manual method, generation of CNC codes using CAM software, Tooling and work holding devices.

UNIT I Introduction to Cam, Geometric Dimensioning and Tolerance 9

CNC machine tools, Principle of operation of CNC,Construction features including structure, drives and CNC controllers, 2D and 3Dmachining on CNC Geometrical dimensioning andtolerancing, Tolerance stacking – types and remedies

UNIT II CNC Part Programming 9

Detailed Manual part programming on Lathe & Millingmachines using G & M codes, FAPT programming (FANUC). Generation of tool path, generation of G & M codes, Optimization of tool path (to reduce machining time)

UNIT III CNC Tooling 9

Different types of tools and tool holders used onCNC Machines, parameters for selection of configuration of cutting tools, work holding devices used on CNC machines

UNIT IV Advanced CNC Processes 9

Introduction to advanced CNC processes, EDM, Wire EDM, Abrasive water jet, LASERcutting, RPT, (Working principles, construction or set up of process, applications)

UNIT V APT Programming 9

APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands. Macro subroutines. Part programming preparation for typical examples

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Computer Applications in Manufacturing course, the student will be able to

CO 1: Design and develop Computer Integrated Manufacturing systems using the knowledge of mathematics, science, engineering and IT tools.

CO 2: Communicate ideas effectively with diversified groups to become lead professionals in academia and industry in advanced areas of manufacturing.

CO 3: Apply knowledge of manufacturing engineering and management principles to design and evaluate automated manufacturing systems.

CO 4: Analyze problems of manufacturing and industrial systems to formulate the design requirements for CIM systems.

CO 5: Formulate competitive priorities and manufacturing strategy for a given production system to derive strategic advantage.

TEXT BOOKS:

1. Bralla, J.G.,“Handbook of product design for manufacture”, McGraw Hill Book Co., 1986.
2. Chang,T.C., Wysk,R.A. and Wang, H.P.,"Computer-Aided Manufacturing", Second Edition, Prentice Hall, 1998

REFERENCES:

1. Jon Stenerson and Kelly Curran “Computer Numerical Control”, Prentice-Hall of India Pvt. Ltd. New Delhi, 2008
2. Ibrahim Zeid “CAD/CAM - Theory and Practice” Mc Hill, International edition, 1998
3. P. N. Rao “CAD/Cam principles and operations”, Tata McGraw Hill
4. Reference Manuals of FANUC, Siemens, Mazak, etc.
5. Thomas M. Crandell “ CNC Machining and Programming, Industrial Press ISBn- 0-8311-3118-7
6. Bedworth, Wolfe and Henderson - “Computer aided design and manufacturing” - McGraw Hill
7. “Manufacturing Science” - A. Ghosh and Malik - Affiliated East West Press Pvt. Ltd.
8. Tilak Raj - “CNC Technology and Programming”, Dhanpat Rai Publication Company.

21DMCI21 DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To study the principles, practices and techniques of Design of Hydraulic and Pneumatic Systems.

UNIT I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 6

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS 12

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT III HYDRAULIC CIRCUITS 6

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits- industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.

UNIT IV PNEUMATIC SYSTEMS AND CIRCUITS 15

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 7

Pneumatic equipments- selection of components - design calculations – application - fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Design of Hydraulic and Pneumatic Systems course, the student will be able to

CO 1: Understand the principles, practices and techniques of Design of Hydraulic and Pneumatic Systems.
CO 2: Explain and design the physical and technological basis of hydraulic and pneumatic devices.
CO 3: Describe development and application of hydraulic and pneumatic systems,
CO 4: Interpret the acquired data and results,devise independently simple hydraulic and pneumatic systems,
CO 5: Create solutions in analysis, design and development of components, devices and equipment of hydraulic and pneumatic systems.

TEXT BOOKS:

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education 2005.
2. Majumdar S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata McGraw- Hill, 2001.

REFERENCES:

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 1980.

2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall,
3. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 1999.
4. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.
5. K.Shanmuga Sundaram, “Hydraulic and Pneumatic Controls: Understanding made Easy" S. Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009).

21MEI106 MECHATRONICS IN MANUFACTURING SYSTEMS

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- This syllabus is formed to create knowledge in Mechatronic systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives a framework of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT I INTRODUCTION 5

Introduction to Mechatronics - Systems- Need for Mechatronics - Emerging area of Mechatronics - Classification of Mechatronics - Measurement Systems – Control Systems.

UNIT II SENSORS AND TRANSDUCERS 12

Introduction - Performance Terminology – Potentiometers - LVDT – Capacitance sensors - Strain gauges - Eddy current sensor - Hall Effect sensor – Temperature sensors - Light sensors - Selection of sensors - Signal processing.

UNIT III ACTUATORS 12

Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of actuators.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 8

Introduction - Basic structure - Input and output processing - Programming - Mnemonics-Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V DESIGN AND MECHATRONICS CASE STUDIES 8

Designing - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronics Control in automated Manufacturing – Data Acquisition Case studies.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Mechatronics in Manufacturing Systems course, the student will be able to

CO 1: Generate conceptual design for Mechatronics products based on potential customer requirements

CO 2: Design a control system for effective functioning of Mechatronics systems using digital electronics, microprocessors, microcontrollers and programmable logic controllers

CO 3: Determine the performance of a Mechatronics system

CO 4: Compute forward and inverse kinematics of robots and determine trajectory plan.

CO 5: Design and select robots for Industrial and Non-Industrial applications.

TEXT BOOKS:

1. Bolton.W, “Mechatronics”, Pearson education, second edition, fifth Indian Reprint, 2003.

2. Bradley, D.A., Dawson. D., Buru, N.C. and Loader, A.J., “Mechatronics” Nelson Thornes Ltd, Eswar press, Indian print, 2004.

REFERENCES:

1. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.

2. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing company, 2007.

3. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.

4. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and applications” Tata McGraw-Hill Publishing Company Limited, 2003

21MEI107 ROBOTICS AND SENSORS

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- On completion of the course the students are expect to the knowledgeable in Robot anatomy, end effectors, sensors, vision systems, and kinematics.

UNIT I INTRODUCTION 5

An Introduction to sensors and Transducers, History and definitions, Smart Sensing, AI sensing, Need of sensors in Robotics.

UNIT II SENSORS IN ROBOTICS 9

Position sensors - optical, non-optical, Velocity sensors, Accelerometers, Proximity Sensors - Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors

UNIT III MISCELLANEOUS SENSORS IN ROBOTICS 11

Different sensing variables - smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Tele-presence and related technologies.

UNIT IV VISION SENSORS IN ROBTICS 10

Robot Control through Vision sensors, Robot vision locating position, Robot guidance with vision system, End effectors camera Sensor.

UNIT V MULTISENSOR CONTROLLED ROBOT ASSEMBLY 10

Control Computer, Vision Sensor modules, Software Structure, Vision Sensor software, Robot programming, Handling, Gripper and Gripping methods, accuracy - A Case study.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Robotics and Sensors course, the student will be able to

CO 1: Classify robots based on joints and arm configurations.
CO 2: Design application specific End Effectors for robots.
CO 3: Program robot to perform typical tasks including Pick and Place, Stacking and Welding.
CO 4: Design and select robots for Industrial and Non-Industrial applications.
Understand many modern devices and technologies used in sensors.
CO 5: Understand the application of various sensors for direct contact and non-contact measurements.

TEXT BOOKS:

1. Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
2. Groover,M.P., Weis,M., Nagel,R.N. and Odrey,N.G., “Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int., 1986.

REFERENCES:

1. Paul W Chapman, "Smart Sensors", an Independent Learning Module Series, 1996.
2. Richard D. Klafer, Thomas a. Chmielewski; Michael Negin, "Robotic Engineering - An integrated approach", Prentice Hall of India Private Limited, 1989.
3. John Iovice, "Robots, Androids and Animalrons", Mc Graw Hill, 1998.
4. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics - Control Sensing, Vision and Intelligence", Mc Graw Hill Internation Editions, 1987.
5. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G. Odrey, "Industrial Robotics - Technology, Programming and Applications", Mc Graw Hill, International Editions, 1986.
6. Sabric Soloman, "Sensors and Control Systems in Manufacturing", Mc Graw Hill, International Editions, 1994.

21MEI108 MANUFACTURING SYSTEM SIMULATION

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To provide knowledge in the concept of manufacturing system simulation environment through the simulation languages and case studies.

UNIT I INTRODUCTION 8

Basic concepts of system – elements of manufacturing system - concept of simulate on – simulation as a decision making tool – types of simulation – Monte-Carlo simulation - system modeling – types of modeling – Limitations and Areas of application of simulation.

UNIT II RANDOM NUMBERS 9

Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – kolmogorov-Smirnov test, the Chi-Square test - sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – data collection and reduction – time flow mechanical – key variables -logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 9

Comparison and selection of simulation languages - Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 9

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – case studies.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Manufacturing System Simulation course, the student will be able to

CO 1: Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.

CO 2: Apply the processes, procedures and techniques which are required for the successful execution of systems engineering methodology to resolve different types of complex problems faced by senior manager, at an earlier stage of system design.

CO 3: Create system reports and system specification documents.

CO 4: Interpret the model and apply the results to resolve critical issues in a real world environment.

CO 5: Design and analyse control mechanism and management function to ensure that the system achieves its purpose.

TEXT BOOKS:

1. Geoffrey Gordon, "System Simulation", 2nd Edition, Prentice Hall, India, 2002.
2. Law A.M, “Simulation Modelling and Analysis”, Tata Mc Graw Hill.

REFERENCES:

3. Jerry Banks and John S.Carson, “Discrete event system simulation”, Prentice Hall 1991
4. John H.Mize and J.Grady Cox, “Essentials of simulation” – Prentice hall 1989.
5. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
6. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
7. Averill M.Law and W.David Kelton, “Simulation Modeling and analysis”, McGraw Hill International Editions, 1991.
8. hannon R.E., “System simulation”, Prentice Hall 1993.

21MEI109 MACHINE VISION AND ITS APPLICATIONS

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To familiarize the students with machine vision system through the various image processing utility and knowing the application of machine vision system.

UNIT I BASIC PRINCIPLE OF MACHINE VISION CONCEPT 8

Introduction to Machine Vision - Advantages of Machine vision - Applications of machine vision. Image Processing- Binary Algorithms- Morphological Operators- Optical Character Recognition.

UNIT II FUNDAMENTALS OF IMAGE PROCESSING 8

Image acquisition Principles and Devices -Binary image processing - Digital Imaging - Grey Scale Modification -Sharpening and Smoothing the images - Regions and Edges - Region representation - image storage - Image enhancement - Image Filtering.

UNIT III DYNAMIC VISION AND OBJECT RECOGNITION 10

Histogram modifications, linear systems and filters. Image Detection -Edge detection- Contours, geometry of curves, Digital curves, Curve fitting, Circular arcs, Conics and Spline curves - Surfaces, representations, interpolation, Approximation, Segmentation, Registration.

UNIT IV IMAGE PROCESSING DEVICES 9

Introduction to Texture, Statistical and Model based analysis of Texture, Structural analysis of ordered texture - Model-Based Methods for Texture Analysis - Shape from Texture, Photometric stereo. Dynamic Vision - Segmentation using Motion and Moving camera Motion.

UNIT V APPLICATION AND INTERFACING 10

Object recognition - Object Representation, Feature Detection, Recognition Strategies, Verification and their applications with examples, two and three dimensional measurements, Inter facing a robot with a Vision system.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Machine Vision and its Applications course, the student will be able to

CO 1: Apply the concepts of calibration, traceability and uncertainty for accurate and reliable measurements.
CO 2: Identify and estimate measurement errors and suggest suitable techniques to minimize them.
CO 3: Enhance digital image using various algorithms with the help of computer programming.
CO 4: Understand the role of image processing in different fields such as medical, engineering, space, biotechnology, ocean, agriculture, food industry, etc.
CO 5: Realize the significance of digital image processing in automation.

TEXT BOOK:

1. Sonka,M., Hlavac,V. and Boyle.R., “Image Processing, Analysis, and Machine Vision”, CengageEngineering, 2007.

REFERENCES:

1. Pham. D.T., Dimov. S. S., 'Rapid manufacturing: the technologies and applications of RPT and rapid tooling', Springer, London, 2001.
2. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
3. Bewoor, A.K. and Kulkarni,V.A.,”Metrology and Measurement”, Tata Mc Graw-Hill, 2009.
4. Galyer, F.W. and Shotbolt, C.R., “Metrology for engineers”, ELBS, 1990.
5. Gupta, I.C., “A Text Book of engineering metrology”, Dhanpat Rai and Sons, 1996.
6. Jain ,R.K.,“Engineering Metrology”, Khanna Publishers, 2008.
7. Rajput,R.K., “Engineering Metrology and Instrumentations”, Kataria & Sons Publishers, 2001.
8. Smith,G.T., “Industrial Metrology”, Springer, 2002
9. Whitehouse, D.J., "Surface and their measurement", Hermes Penton Ltd, 2004.

21MEI110 METAL FORMING TECHNOLOGY

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- At the end of the course the student should be able to understand the advances in metal forming.

UNIT I THEORY OF PLASTICITY 9

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress-strain relation – Mohr's circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – Overview of FEM applications in Metal Forming analysis.

UNIT II HEORY AND PRACTICE OF BULK FORMING PROCESSES 9

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.

UNIT III SHEET METAL FORMING 9

Formability studies – Conventional processes – H E R F techniques – Super plastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application

UNIT IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES 9

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming

UNIT V SURFACE TREATMENT AND METAL FORMING APPLICATIONS 9

Experiment techniques of evaluation of friction in metal forming selection – influence of temperature and gliding velocity – Friction heat generation – Friction between metallic layers – Lubrication carrier layer – Surface treatment for drawing, sheet metal forming, Extrusion and hot and cold forging. Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling – Thermo mechanical regimes of Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Metal Forming Technology course, the student will be able to

CO 1: Understand the theoretical foundations and methodology necessary for solving metal-forming technologies on the principles of plastic deformation and theory of plasticity.

CO 2: Know the necessary for a creative and complex engineering solution of the technologies of metal-forming processes.

CO 3: Understand the fundamental principles such as the physical, chemical, mechanical and thermodynamic principles of metallic bodies changing from the elastic into the plastic state, and when these bodies are plastically deformed into the required shape.

CO 4: Explain the elements of the theory of plasticity, fundamentals of metal working, forging process, rolling process, extrusion process, drawing of rods, wires and tubes, sheet metal forming process, high energy rate forming.

CO 5: Understand the loading of the forming tool or machine, and how to determine the critical values of deformation.

TEXT BOOKS:

1. Narayanaswamy, R., Theory of Metal Forming Plasticity, Narosa Publishers,1989.
2. Pandley, P.S. and Shah.N., "Modern Manufacturing Processes", Tata McGraw Hill, 1980.

REFERENCES:

1. Dieter G.E., Mechanical Metallurgy (Revised Edition II) McGraw Hill Co., 2004
2. Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003.
3. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003
4. SHIRO KOBAYASHI, SOO-IK-oh-ALTAN, T,Metal forming and Finite Element Method, Oxford University Press, 2001.
5. ALTAN.T, SOO-IK-oh, GEGEL, HL – Metal forming, fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1983.
6. Marciniak,Z., Duncan J.L., Hu S.J., 'Mechanics of Sheet Metal Forming', Butterworth-Heinemann An Imprint of Elesevier, 2006
7. Proc. Of National Seminar on "Advances in Metal Forming" MIT, March 2000
8. SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007

21MEI111 NEWER WELDING AND CASTING PROCESSES

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- At the end of the course the student should be able to understand the welding and various casting processes in production environment.

UNIT I CASTING DESIGN 8

Heat transfer between metal and mould –– Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

UNIT II CASTING METALLURGY 8

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

UNIT III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 8

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

UNIT IV WELDING METALLURGY AND DESIGN 10

Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

UNIT V RECENT TRENDS IN WELDING 11

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Newer Welding and Casting Processes course, the student will be able to

CO 1: Understand basic definitions the Welding and casting process

CO 2: Describe the Melting Furnaces & Special moulding Process

CO 3: Classify various manufacturing process and list the types of patterns and binders

CO 4: List types of moulds and cores and classify types of sand used for preparing the same. Sketch the types of mould machine, casting defects

CO 5: Define and classify various welding process and sketch the special t ype of welding process

TEXT BOOKS:

1. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002.
2. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002.

REFERENCES:

1. ASM Handbook, Vol 15, Casting, 2004
2. ASM Handbook vol.6, welding Brazing & Soldering, 2003
3. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2000.
4. Jain P.L., Principles of Foundry Technology,Tata McGrawHill Publishers, 2003
5. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
6. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
7. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981.
8. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers,1994.
9. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980

21MEI112	DESIGN OF CELLULAR MANUFACTURING SYSTEM	L	T	P	C
		4	0	0	4

COURSE OBJECTIVE:

At the end of this course the student should be able to understand

- Concepts and applications of Cellular manufacturing systems
- Traditional and non-traditional approaches of Problem solving
- Performance measurement
- Human and economical aspects of CMS.

UNIT I INTRODUCTION 12

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

UNIT II CMS PLANNING AND DESIGN 10

Problems in GT/CMS - Design of CMS - Models, traditional approaches and non- traditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.

UNIT III IMPLEMENTATION OF GT/CMS 10

Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

UNIT IV PERFORMANCE MEASUREMENT AND CONTROL 8

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT V ECONOMICS OF GT/CMS: 5

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Design of Cellular Manufacturing System course, the student will be able to

CO 1: Understand the effect of manufacturing automation strategies and derive production metrics.

CO 2: Analyze automated flow lines and assembly systems, and balance the line.

CO 3: Design automated material handling and storage systems for a typical production system.

CO 4: Develop CAPP systems for rotational and prismatic parts.

CO 5: Classify and distinguish NC, CNC and DNC systems, Understand CNC machine structures and system drives and develop interpolation algorithms for control loops.

TEXT BOOK:

1. Burbidge, J.L. Group " Technology in Engineering Industry ", Mechanical Engineering pub. London, 1979.

REFERENCES:

1. Cleland.D.I. and Bidananda, B. (Eds), "The automated factory handbook: technology and management", TAB Books , NY, 1991.
2. Irani, S.A. " Cellular Manufacturing Systems ", Hand Book
3. Askin, R.G. and Vakharia, A.J., G.T " Planning and Operation, in The automated factory-Hand Book:Technology and Management ", Cleland.D.I. and Bidananda, B (Eds), TAB Books , NY, 1991.
4. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems ", Elsevier, 1995.

21MEI113 INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To enhance the knowledge of the students about various measuring instruments, operation of different measurement technology, instruments transducers and their application in automotive industry.
- To understand the various steps involved in error analysis and uncertainty analysis of the automotive industry

UNIT I MEASUREMENT SYSTEMS 6

Static and Dynamic Measurement systems- Requirements and characteristics – Analysis of experimental detail, Error analysis.

UNIT II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 8

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III MECHANICAL MEASUREMENT 10

Instrumentation For Measuring Weight , Force, torque , pressure power, temperature, fluid flow, vibration, rotational speed , velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES 12

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature Dynamic Cylinder pressure measurements.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 9

Introduction to various vehicle experimental techniques, Laboratory tests- vehicle tracks test - Vehicle endurance Tests- Vehicle crash tests- Vehicle wind tunnel tests- Vehicle Brake tests.

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of Instrumentation and Experimental Techniques course, the student will be able to

CO 1: Develop among the students, the competence to analyze systems, develop models, design controllers and configure automation systems.

CO 2: Impart practical knowledge in process control and design of instrumentation systems.

CO 3: Prepare students' to have successful career in industry / R&D organization and academic institutions.

CO 4: Enhance the knowledge of the students about various measuring instruments, operation of different measurement technology, instruments transducers and their application in automotive industry.

CO 5: Understand the various steps involved in error analysis and uncertainty analysis of the automotive industry.

TEXT BOOKS:

1. J.G. Giles, ‘Engine and Vehicle Testing’, Illiffe books Ltd., London,1968.
2. T.G. Beckwith and Buck, ‘Mechanical Measurements’, Oxford and IBH Publishing House, New Delhi, 1995

REFERENCES:

1. A.W. Judge, ‘Engineering Precision Measurement’, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. D.Patambis, ‘Principle of Industrial Instrumentation’, Tata McGraw Hill Publishing Co, New Delhi, 1990.
3. Rangan, Sharma and Mani, ‘Instrumentation Devices and systems’, Tata McGraw Hill Publishing Co., Ltd., 1990
4. Anthony Martyr, Michael Alexander Plint, ‘Engine Testing’, Elsevier, 2012.

21MEI114 INTERNET OF THINGS FOR MANUFACTURING

L	T	P	C
4	0	0	4

OBJECTIVES:

- To discover key IoT concepts including identification, sensors, localization, wireless protocols
- To explore IoT technologies, architectures, standards, and regulation
- To realize the value created by collecting, communicating, coordinating, and leveraging data
- To examine developments that will likely shape the industrial landscape in the future.

UNIT I INTRODUCTION **9**

Technology of the IoT and applications,. IoT data management requirements, Architecture of IoT, Security issues Opportunities for IoT -Issues in implementing IoT. Technological challenges, RFID and the Electronic Product Code (EPC) network, the web of things.

UNIT II DESIGN OF IoT **9**

Design challenges in IoT -Standardization, Security and privacy, Infrastructure, Analytics. Design steps for implementing IoT.

UNIT III PROTOTYPING OF IoT **9**

Design principles for connected devices -Embedded devices, physical design, online components, embedded coding system. Informed Manufacturing plant – Elements, IoT implementation in Transportation and logistics, Energy and utilities, Automotive Connected supply chain, Plant floor control automation, remote monitoring, Management of critical assets, Energy management and resource optimization, proactive maintenance.

UNIT IV PREREQUISITES FOR IoT **9**

IOT Technologies Wireless protocols low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications Data storage and analysis Localization algorithms Localization for mobile systems

UNIT V APPLICATION IN MANUFACTURING **9**

Applications HCI and IoT world - Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of INTERNET OF THINGS FOR MANUFACTURING course, the student will be able to

CO 1: Utilizing sensors to gain greater visibility and real-time situational awareness

CO 2: Vertical applications that provide a clear business case and a pressing opportunity

CO 3: Emerging technologies to address IoT challenges

CO 4: Application and interactions robotics and autonomous vehicles.

CO 5: Design principles of manufacturing plant

TEXT BOOKS:

1. Adrian McEwan and Hakim Cassimally, “Designing the internet of things”, Wiley, 2013

2. Code Halos: How the Digital Lives of People, Things, and Organizations are Changing the Rules of Business, by Malcolm Frank, Paul Roehrig and Ben Pring, published by John Wiley & Sons.

REFERENCES:

1. Internet of Things: A Hands-On Approach by Vijay Madisetti, Arshdeep Bahga, VPT; 1st edition 2014.

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence” Elsevier

3. Meta Products -Building the Internet of Things by Wimer Hazenberg, Menno Huisman, BIS Publishers 2014.

21MEI115	FLEXIBLE MANUFACTURING SYSTEMS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVE:

- To introduce the various Modern manufacturing systems.
- To understand the concepts and applications of flexible manufacturing systems

UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS **9**

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS **9**

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE **9**

Application of simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS **9**

Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS-application of possibility distributions in FMS systems justification.

UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE **9**

FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Product Development and Manufacture course, the student will be able to

CO1: Perform Planning, Scheduling and control of Flexible Manufacturing systems

CO2: Perform simulation on software's use of group technology to product classification

CO3: Make a prototype of a FMS simulation and data base.

CO4: Make Group Technology and justification of FMS layout

CO5: Identify the applications of FMS and factory of the future

TEXT BOOKS:

1. Jha, N.K. “Handbook of flexible manufacturing systems”, Academic Press Inc., 1991.
2. DR. H.K. Shivanand, M.M. Benal, V. Koti, “Flexible Manufacturing Systems”, New Age International (P) Limited, Publishers, 2006.

REFERENCES:

1. Radhakrishnan P. and Subramanyan S., “CAD/CAM/CIM”, Wiley Eastern Ltd., New Age International Ltd., 1994.
2. Raouf, A. and Ben-Daya, M., Editors, “Flexible manufacturing systems: recent development”, Elsevier Science, 1995.
3. Groover M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt., New Delhi, 1996.
4. Kalpakjian, “Manufacturing Engineering and Technology”, Addison-Wesley Publishsing Co., 1995.
5. TaiichiOhno, “Toyota Production System: Beyond large-scale Production”, Productivity Press (India) Pvt. Ltd. 1992.

21MEI116 SENSORS FOR MANUFACTURING AND CONDITION MONITORING

L	T	P	C
4	0	0	4

OBJECTIVE:

To impart knowledge of sensor technologies used in the manufacturing industry for monitoring workpieces, machine tools, machining processes and advanced sensors.

UNIT I INTRODUCTION TO SENSORS **9**

Role of sensors in manufacturing and condition monitoring – Principles – Classification Applications – Basic requirements of sensor – Signal processing and decision making.

UNIT II SENSORS FOR WORKPIECE MONITORING **9**

Mechanical, Electrical, Electro-mechanical, Opto-electrical, Optical, Pneumatic, Capacitance, Eddy-current and Magnetic sensors.

UNIT III SENSORS FOR MACHINE TOOL MONITORING **9**

Position measurements: Linear, angular and velocity sensors – Calibration of machine tools – Collision detection measurements.

UNIT IV SENSORS FOR MACHINING PROCESSES **9**

Sensors for condition monitoring: Force, torque, power, temperature, vibration, acoustic emission, tool sensors, chip control sensors – Adaptive control system – Intelligent systems for machining processes.

UNIT V ADVANCED SENSORS **9**

Optical and machine vision sensors – Smart/Intelligent sensors – Integrated sensors – Robot sensors – Micro-sensors – Nano-sensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of SENSORS FOR MANUFACTURING AND CONDITION MONITORING course, the student will be able to

CO 1: Understand and applications of various sensors

CO 2: Working principle of workpiece monitoring sensor

CO 3: Working principle of machine tool monitoring sensor

CO 4: Understand and principles of intelligent machining system.

CO 5: Develop knowledge about advanced sensor

TEXT BOOKS:

1. Considine, D.M. and Glenn, D., “Standard Handbook of Industrial Automation: Advanced Industrial Technology 01”, Chapman and Hall, New York, DOI: 10.1017/S0263574700004392, 1987.
2. Sinclair, I.R., “Sensors and Transducers” Elsevier India Private Limited, New Delhi, India, ISBN: 978-0-7506-4932-1, 2001.

REFERENCES

1. Tönshoff, H.K. and Inasaki, I., “Sensors in Manufacturing: Sensors Applications- Volume1”, Wiley-VCH Verlag GmbH, Weinheim, ISBNs: 3-527-29558-5 (Hardcover); 3-527-60002-7 (Electronic), 2001.
2. Venkatesh, V.C. and Chandrasekaran, H., “Experimental Techniques in Metal Cutting”, Prentice-Hall of India Private Limited, New Delhi, India, ISBN: 0-87692-449-6, 1987.
3. Wang, L. and Gao, R.X., “Condition Monitoring and Control for Intelligent Manufacturing”, Springer-Verlog London Limited, ISBN-13:978-1-84628-263-3, 2006.

21MEI117	INDUSTRIAL ROBOTICS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVE:

- The objective of the course is to provide a mathematical introduction to the mechanics and control of robots that can be modeled as kinematic chains.

UNIT I INTRODUCTION **9**

Introduction to Robotics- Robot, Robotics, Types of Robot, Robot classification, Types of Robot, Degrees of freedom.

UNIT II KINEMATICS AND DYNAMICS OF ROBOTIC LINKS **9**

Kinematics and Dynamics of Robotic linkages (open ended type manipulators)- Frames, Transformations: Translation and rotation, Denavit-Hartenberg parameters, Forward and Inverse Kinematics, Jacobian, Dynamics: Equations of motion, Newton-Euler formulation.

UNIT III SENSORS AND ACTUATORS **9**

Sensors and actuators- Strain gauge, resistive potentiometers, Tactile and force sensors, tachometers, LVDT, Piezoelectric accelerometer, Hall effect sensors, Optical Encoders, Pneumatic and Hydraulic actuators, servo valves, DC motor, stepper motor, drives.

UNIT IV CONTROLLERS **9**

Control of Manipulators- Feedback control of II order linear systems, Joint control, Trajectory control, Controllers, PID control.

UNIT V ROBOT PROGRAMMING **9**

Robot Programming-Language-overview, commands for elementary operations.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the Industrial Robotics course, the student will be able to

CO1: Identify the electrical, electronic and mechanical components and use of them design or machine elements and transmission system.

CO2: Understand the features and operation of automation products.

CO3: Identify the various sensors and actuators using in the manufacturing cells with robotic control.

CO4: Understand the various controllers' manipulators using in industrial robotics.

CO5: Write the programming for the industrial robotics.

TEXT BOOKS:

1. GrooverMikell .P, "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2014.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 2013.

REFERENCE :

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2009.
2. Fu. K.S, Gonzalez. R.C, Lee. C.S.G “Robotics – Control, Sensing, Vision, and Intelligence”, McGraw Hill, 2015.
3. Klafter,R.D., Chmielewski, T.A. and Negin,M., “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
4. Koren,Y., “Robotics for Engineers”, McGraw-Hill, 1987.
5. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.

21MEI118 RAPID PROTOTYPING AND TOOLING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields.

UNIT I INTRODUCTION **7**

Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping - Virtual prototyping.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS **10**

Stereo lithographyApparatus, Fused deposition Modeling, Laminated object manufacturing, Three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS: **10**

Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.

UNIT IV REVERSE ENGINEERING ANDCAD MODELING **10**

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT V RAPID TOOLING **8**

Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Rapid Prototyping and Tooling course, the student will be able to

CO 1: Describe tool design methods and punch and die manufacturing techniques.

CO 2: Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature

CO 3: Interpret the principles of clamping, drill jigs and computer aided jig design

CO 4: Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools

CO 5: Ability to apply the fundamentals of rapid prototyping techniques.

TEXT BOOKS:

1. Benedict, G.F.,"Non Traditional manufacturing Processes",CRC press,2011
2. Franssila. S., “Introduction to Micro Fabrication”, John Wiley and sons Ltd., UK, 2004, ISBN: 978-0-470-85106-7.

REFERENCES:

1. Jackson, M.J., “Micro fabrication and Nanomanufacturing”, CRC Press, 2006.
2. Madou, M.J., Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition, CRC Press (ISBN: 0849308267), 2006.
3. McGeough, J.A.,"Advanced methods of Machining",Springer,2011
4. Narayanaswamy, R., Theory of Metal Forming Plasticity, Narosa Publishers,1989.
5. Pandley, P.S. and Shah.N., “Modern Manufacturing Processes”, Tata McGraw Hill, 1980.

SYLLABUS
GENERIC ELECTIVE COURSES

21CMCI11 TOTAL QUALITY SYSTEM AND ENGINEERING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

To study the principles practices and techniques of quality systems and engineering.

UNIT I INTRODUCTION **10**

Principles of Quality Management - Pioneers of TQM - Quality costs – Customer Orientation - Benchmarking - Re-engineering - Concurrent Engineering.

UNIT II PRACTICES OF TQM **10**

Quality system - ISO 9001:2000 - QS 9000, ISO 14000 - Quality Auditing - Leadership - Organizational Structure - Team Building - Information Systems and Documentation.

UNIT III TECHNIQUES OF TQM **10**

Single Vendor Concept - J.I.T. - Quality Function deployment - Quality Circles - KAIZEN - SGA - POKA YOKE - Taguchi Methods.

UNIT IV QUALITY BY DESIGN **8**

Introduction – Rationale for implementation – Benefits– Teams – Communication models Implementation – Tools – Misconceptions and Pitfalls.

UNIT V PRODUCTS LIABILITY **7**

Introduction – Product safety law – products liability law – defenses – Proof and the expert witness – Financial Loss – The future of products liability – Prevention.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Total Quality System and Engineering course, the student will be able to

CO 1. Understand the philosophy and core values of Total Quality System and Engineering.

CO 2. Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization; apply and evaluate best practices for the attainment of total quality.

CO 3. Imparting total quality system in education to develop innovative, entrepreneurial and ethical future professionals fit for globally competitive environment.

CO 4. Develop in-depth knowledge on various tools and techniques of Total Quality System and Engineering.

CO 5. Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.

TEXT BOOKS:

1. Baird, C.W., “The Six Sigma Manual for Small and Medium Businesses”, Atlantic Publishing Company (FL), Reprint 2011.

2. Bank, J., " The Essence of Total Quality Management ", Prentice Hall of India Pvt.Ltd., 1995.

REFERENCES:

1. Harvid Noori and Russel, " Production and Operations mangement - TotalQuality and Responsiveness ", McGraw-Hill Inc, 1995.
2. Suresh Dalela and Saurabh, ISO 9000 " A Manual for Total Quality Management" S.Chand and Company Ltd., 1997.
3. John Bank, " The Essence of Total Quality Management ", Prentice Hall of India Pvt.Ltd., 1995.
4. Mohamed Zairi, " Total Quality Management for Engineers ", Woodhead Publishing Limited 1991.
5. Besterfield D.H., Besterfield C.M, Besterfield G.H and Besterfield M.S., “Total Quality Management ", Pearson Education, 2002.
6. R. Pugazhenthi, A. Baradeswaran, K. Balachandran, and P. Balamurali, “Total Quality Management”, sams publications, 2015.

21CMCI12 MANUFACTURING INFORMATION SYSTEMS

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- The purpose of the course is to provide an importance of databases and its application in manufacturing systems that prepare students for their engineering practice by organization by conversant with order policies, data base terminologies, designing, manufacturing considerations.

UNIT I INTRODUCTION **5**

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE **7**

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE **13**

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query

UNIT IV MANUFACTURING CONSIDERATION **10**

The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module, Input/output analysis module the stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING **10**

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Manufacturing Information Systems course, the student will be able to

CO 1: Provide an importance of databases and its application in manufacturing systems that prepare students for their engineering practice by organization by conversant with order policies, data base terminologies, designing, manufacturing considerations.

CO 2: Understand the role of non-IT managers in information systems planning, systems development, and hardware and software selection.

CO 3: Discuss and evaluate engineering data management issues across the extended enterprise.

CO 4: Demonstrate an appreciation of the complex relationship between information systems and organisation.

CO 5: Define problems and the current environment for existing business systems in the areas of accounting, finance, marketing, and manufacturing.

Text Books:

1. Date, C.J., ”An Introduction to Database Systems” Addison Wesley”, 8th Edn,. 2003
2. Franjo, C., “Manufacturing Information & Data Systems Analysis, Design & Practice”, Butterworth-Heinemann, 2002.

REFERENCES:

1. Kerr.R, “Knowledge based Manufacturing Management”, Addison-Wesley,1991.
2. RFID in Manufacturing, Gunther Oliver, Kletti Wolfhard, Kubach.vwe.,2008
3. Manufacturing Information & Data Systems Analysis, Design & Practice, CECELJAFRANJO, 2002.
4. Luca G.Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988.
5. Date.C.J.,”An Introduction to Database Systems” Addison Wesley, 8th Edn,.2003
6. Orlicky.G., “Material Requirements Planning”, McGraw-Hill, 1994.

21CMCI21 SUPPLY CHAIN MANAGEMENT

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

At the end of this course the student should be able to understand

1. Importance of supply chain
2. Logistics management
3. Design factors of supply chain
4. Sourcing and revenue management
5. Managing the supply chain.

UNIT I INTRODUCTION 6

Definition of Logistics and SCM: Evaluation, Scope Importance & Decision phases – Drivers of SC performance and Obstacles-Development trends- Centralized vs Decentralized Planning and Scheduling- Green Paradigms

UNIT II LOGISTICS MANAGEMENT 10

Factors – Modes of transportation – Design options for transportation Networks - Routing and Scheduling – Inbound and outbound logistics –Reverse Logistics – 3PL– Integrated Logistics concepts- Integrated Logistics Model – Activities – Measuring logistics cost and performance – Warehouse Management – Case Analysis.

UNIT III SUPPLY CHAIN NETWORK DESIGN 10

Distribution in supply chain – Factors in Distribution network design – design Options– Network Design in supply chain – A facility location model featuring supply chain aspects, Multi-period supply chain planning, A heuristic for the multi-period SCND problem- Framework for network Decisions – Managing cycle inventory and safety.

UNIT IV SOURCING AND PRICING IN SUPPLY 9

Supplier Selection and contracts – design collaboration – Procurement process, the progression from a procurement focus to strategic sourcing focus Supplier Management- Supplier Relationship Management- Supply Base Management. Revenue management in supply chain- Realize the benefits- Impact the Bottom-line/

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN 10

Supply Chain Coordination – Bullwhip effect of lack of Coordination and obstacles – IT and SCM – supply Chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Supply Chain Management course, the student will be able to

CO 1: Develop a systematic framework for analyzing the behavior of large and complex supply chain networks.

CO 2: Utilize information technology and various quantitative and qualitative approaches that reduce production, inventory and transportation costs, and improve service levels and profitability.

CO 3: Acquire familiarity and a working knowledge of the principles and practice of operations management as applied to the service industries.

CO 4: Understand terminology, applications, and tools which are essential for managing operations in service industries.

CO 5: Design factors of supply chain, implement the logistics management, managing the supply chain and Sourcing and revenue management

TEXT BOOKS:

1. Ayers, J.B., “Handbook of Supply Chain Management”, Taylor and Francis Group, 2006.
2. Bloomberg, D.J., Lemay, S. and Hanna, J.B.,’Logistics”, PHI 2002.

REFERENCES:

1. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002.
2. Logistics and Supply Chain Management – Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition.
3. Modeling the supply Chain, Jeremy F.Shapiro, Thomson Duxbury, 2002.
4. Handbook of Supply Chain Management, James B.Ayers, St.Lucle Press, 2000.
5. Supply chain management, Strategy, Planning, and Operation – Sunil Chopra and Peter Meindl – PHI, Second edition, 2004.

21CMCI22	RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To teach the essentiality of reliability engineering, reliability prediction and the implementation of total productive maintenance.

UNIT I RELIABILITY AVAILABILITY AND MAINTAINABILITY ENGINEERING 9

Reliability engineering fundamentals and applications -Reliability function - MTBF - MTTF - mortality curve - availability -Maintainability Definition and application of Maintainability Engineering- Factors affecting Maintainability- Maintainability design criteria, operating and down time categories,

UNIT II FAILURE DATA ANALYSIS 9

Repair time distributions - exponential, normal, log normal, gamma, and Weibull - reliability data requirements - Graphical evaluation.

UNIT III RELIABILITY PREDICTION 9

Failure rate estimates - Effect of environment and stress - Series and Parallel systems - RDB analysis – Standby Systems - Complex Systems.

UNIT IV RELIABILITY MANAGEMENT 9

Reliability demonstration testing - Reliability growth testing - Duane curve -Risk assessment FMEA, Fault tree.

UNIT V TOTAL PRODUCTIVE MAINTENANCE: 9

Causes of Machine Failures - Downtime - Maintenance policies - Restorability predictions - Replacement models - Spares provisioning -Maintenance management– Total Productive Maintenance – Maximizing equipment effectiveness – Organizing for TPM implementation – Implementation – TPM small group activities.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Reliability and Total Productive Maintenance course, the student will be able to

CO 1: Problem solving and decision making (analysis and synthesis, analytical and system thinking, intuition, judgment, result interpretation).

CO 2: Advanced technical competence (engineering science, modeling, simulation, testing, correlation, validation, result interpretation).

CO 3: Develop your ability in formulating suitable maintenance strategies to achieve reliable a manufacturing system.

CO 4: Understand the relationship of key concepts in reliability engineering and application to maintenance strategies in a manufacturing environment.

CO 5: Establish maintenance strategies according to system characteristics and design transition programs to implement these strategies.

TEXT BOOK:

1. Birolini, A., “Reliability Engineering: Theory and Practice”, Springer, 2010.

REFERENCES*:*

1. Paul Kales, “Reliability for technology Engineering and Management ", PrenticeHall, New Jersey, 1998.
2. Gopalakrishnan.P, and Banerji A.K., “Maintenance and Spare PartsManagement ", Prentice Hall of India, New Delhi, 1996.
3. Modarres, "Reliability and Risk Analysi ", Meral Dekker Inc., 1993.
4. Nakajima, Seiich, “Introduction to TPM”, Productivity Press, 1988.

21CMCI31 INFORMATION SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To provide knowledge in the concept of information system processing, decision making, analysis and design, quality assurance and knowledge based systems.

UNIT I COMPUTER BASED INFORMATION SYSTEM 7

Concept of information and system – system classification –The challenge of information system – Computers and information processing – managing data resource – organizing data in a traditional file environment – a modern database environment – designing database.

UNIT II MANAGEMENT INFORMATION SYSTEM 10

Concepts – Design and implementation of MIS – Information system for decision making, types and levels of decision making – MIS as a technique for making programmed decisions – Decision – Assisting information systems – Conceptual system design – detailed system design.

UNIT III OVERVIEW OF SYSTEM DEVELOPMENT 10

System analysis – System Design – Completing the system development process the traditional system life cycle – Stages and limitations of life cycle approach – case study.

UNIT IV QUALITY AND SERVICES 10

Traditional tool and Methodologies for quality assurances – New approaches to quality – Information system failure causes – the concept of implementation – controlling risk factor.

UNIT V KNOWLEDGE – BASED SYSTEMS 8

Decision Support Systems – Group DSS – ESS – Artificial Intelligence – Expert System – Other intelligent technique – Neural network, Genetic Algorithm, Fuzzy Logic.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Information Systems Analysis and Design course, the student will be able to

CO 1. Provide knowledge in the concept of information system processing, decision making, analysis and design, analysis the information systems.
CO 2. Define and describe the five phases of the system development life cycle.
CO 3. Describe how systems analysts interact with users, management, and other information systems professionals.
CO 4. Develop data flow diagrams, decision tables and Perform a feasibility study.
CO 5. Determine methods for evaluating the effectiveness and efficiency of a system.

TEXT BOOK:

1. Kenneth C.Laudon and Jane P.Laudon, “Management Information Systems”, Prentice Hall of India Pvt. Ltd., 10th Edn., 2007.

REFERENCES:

1. Robert G.Mudrick, Joel E.Ross and James R.Clagget, “Information System for Modern Management”, Prentice Hall of India Pvt. Ltd., 1995.
2. Chung.P.W.H and Lovegrove G., “Industrial and Engineering Application of AI and Expert systems”, Gardon Breach Science Publication, 1993.
3. Davis.G.B. MIS, “Conceptual Foundation, Structure and Development” McGraw-Hill Publishing Co., 1985.

21CMCI32 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

- To educate students in productivity management and re-engineering environment.

UNIT I PRODUCTIVITY 5

Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organisation level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 12

Conceptual frame work, Management by Objectives (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANISATIONAL TRANSFORMATION 8

Elements of Organisational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process reengineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 10

PMI models - Edosomwan model - Moen and Nolan strategy for process improvement - LMICIP model - NPRDC model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION 10

Analytical and process tools and techniques - Information and communication technology - Enabling role of IT, RE-opportunities, process redesign - cases. Software methods in BPR - specification of BP, case study - Order processing - user interfaces - maintainability and reusability.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of Productivity Management and Re-Engineering course, the student will be able to

CO 1: Understanding of the interaction of organisational goals and objectives and how engineering companies should be structured to efficiently achieve these goals in the prevailing industrial environment.

CO 2: Understanding of the importance of product and service development and their effects on the management, operations, and personnel of engineering organizations.

CO 3: Develop analytical and problem solving skills in dealing with legacy systems and software integration challenges.

CO 4: Develop on hands experience in reverse engineering and reengineering existing software systems.

CO 5: Apply the methods learned to assess the situation of a small-scale legacy system and decide a suitable reengineering strategy for it, in the light of the objectives of the reengineering/renovation effort.

TEXT BOOK:

1. Edosomwan, J.A., “Organisational transformation and process re-engineering", British Library cataloging in pub. data, 1996.

REFERENCES:

1. Premvrat, Sardana,G.D. and Sahay, B.S, “Productivity Management - A systems approach”,Narosa Pub. New Delhi, 1998.
2. Sumanth,D.J.,“Productivity engineering and management”, TMH, New Delhi,1990.
3. Rastogi,P.N. “Re-Engineering and Re-inventing the enterprise”, Wheeler pub.New Delhi, 1995.
4. Noori, H. and Radford,R., " Production and Operations management - Total Quality and Responsiveness ", McGraw-Hill Inc, 1995.

SYLLABUS OF
AUDIT COURSES

21MSUD11	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVE:

- The purpose of the course is to acquaint the students with basic principles of the Constitution of India and its working.

UNIT I NATURE, OBJECT AND SCOPE OF THE CONSTITUTION 6

Nature, object and scope of Constitutional Law and Constitutionalism – Historical Perspective of the Constitution of India – Salient Features and Characteristics of Constitution of India.

UNIT II FUNDAMENTAL RIGHTS 6

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

UNIT III DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES 6

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

UNIT IV FEDERAL STRUCTURE 6

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNIT V AMENDMENT AND EMERGENCY PROVISIONS 6

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Constitution of India course, the student will be able to

CO1: Understand the historical perspective of the Constitution of India and Meaning of the constitution law.

CO2: Know the Fundamental Rights and Fundamental Duties and its legal status

CO3: Understand the Federal structure and distribution of legislative and financial powers between the Union and the States.

CO4: Know the Parliamentary Form of Government in India; The constitution powers and status of the President of India.

CO5: Understand the Emergency Provisions of National Emergency, President Rule, and Financial Emergency.

REFERENCE BOOKS:

1. V.N. Shukla, “Constitutional Law of India”, Eastern Book Company, 1982.
2. D.D. Basu, “Commentary on the Constitution of India”; Vol 12; LexisNexis, 2018.
3. S Pal, “India’s Constitution –Origins and Evolution”, LexisNexis, 2018.
4. Dr J N Pandey, “Constitutional Law Of India”, Central Law Agency, 2020.
5. V.D. Mahajan, “Constitutional Law of India”, Eastern Book Company, 19991.

21MAUD21	SAFETY MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVE:

- To provide the necessary basic concepts of safety in the industrial environment
- To enable the students to learn about various functions and activities of safety department.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance in manufacturing environment.

UNIT I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES 6

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines.

UNIT II PRINCIPLES OF MACHINE GUARDING 6

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening Selection and suitability: lathe-drilling-boring-milling -grinding-shaping

UNIT III SAFETY IN WELDING AND GAS CUTTING 6

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS 6

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls.

Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills Safety in gas furnace operation.

UNIT V SAFETY IN FINISHING, INSPECTION AND TESTING 6

Heat treatment operations, electro plating, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing

Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Industrial Safety course, the student will be able to

CO1: Understand the safety measures in metal & wood machinery
CO2: Know the principles of machine guarding
CO3: Acquire the knowledge in welding & gas cutting
CO4: Understand Safety precautions in cold & hot farming metals
CO5: Gain knowledge in inspection & testing

TEXT BOOKS:

1. John V. Grimaldi and Rollin H. Simonds, “Safety Management”, All India Travelers Book seller, New Delhi, 1989.
2. N.V. Krishnan, “Safety in Industry” Jaico Publishery House, 1996.

REFERENCE BOOKS:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. Indian Boiler acts and Regulations, Government of India.
4. Safety in the use of wood working machines, HMSO, UK 1992.
5. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

21MSUD13 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

COURSE OBJECTIVE:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management
3. To build skills to respond to disaster

UNIT I Definition and types of disaster **6**

Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

UNIT II Study of Important disasters **6**

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management.

UNIT III Environmental impact of disasters **6**

Drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics Causes.

UNIT IV Mitigation and Management techniques of Disaster **6**

Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, Building design and construction in highly seismic zones, retrofitting of buildings.

UNIT V Training, awareness program and project on disaster management **6**

Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas.

TEXT BOOKS:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.

REFERENCES:

1. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
2. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
3. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

21MSUD12	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

Course Objectives:
Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. Identify critical evidence gaps to guide the development.

UNIT I Introduction and Methodology
Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Model Curriculum of Engineering & Technology PG Courses

UNIT II Overview of methodology and Searching
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III Evidence on the effectiveness of pedagogical practices
Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV Professional development:
Alignment with classroom practices and follow-up support Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V Research gaps and future directions
Research design, Contexts , Pedagogy ,Teacher education , Curriculum and assessment ,Dissemination and research impact.

Course Outcomes:
Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

REFERENCE BOOK

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International
5. Journal Educational Development, 33 (3): 272–282. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

21MSUD22	STRESS MANAGEMENT BY YOGA	L	T	P	C
		0	0	2	0

COURSE OBJECTIVE:

1. Meaning of yoga, Importance of yoga in our daily life, important aspects during of yoga.
2. Different type of yoga.
3. Renowned Yogies of India.
4. Importance of Way of Meditation.
5. Knowledge of Samadhi and Nabhi- Pariksha.

COURSE CONTENT

Meaning & Importance of Yoga, Importance of Precautions of Place. Time and Food. Helpful and disturbing aspects during practice of yoga.Various Kinds of yoga:-Bhakti Yoga, Karma Yoga, Hatha Yoga & Ashtang Yoga. Introduction of some prominent yogis-Maharishi Patanjali Swami Shivananda. Chakras and their importance, Kundalini, Five Kleshs, Five States (Bhumies) of Chitra.

REFERENCES:

1. Ghosh,A.K., “A Synthetic approach to Diet and Nutrition”, Swami Mangalteerthama Nutan Publication, Deoghar, 2005.
2. Iyengar, B.K.S., “Astadal Yoga Mala, (Vol I – VIII)”, Allied publishers Pvt. Ltd., Lucknow, 2009.
3. Dr. Rakhee Mehra, “Ayurveda Eka Parichaya”, MDNIY, New Delhi, 2010.
4. Goel, Aruna & Goel, S. L., “Stress Management and Education”, Deep & Deep Publications New Delhi, 2005.

21MSUD23	VALUE EDUCATION	L	T	P	C

COURSE OBJECTIVE:

2 0 0 0

1. To understand importance and need for value education.
2. Appreciate various activities organized by the schools to develop desirable values in the students
3. Conduct various talks and programs for value education and gain knowledge of various models for value education
4. Understand role of teachers for inculcation of values in the students

UNIT I Value Education & Need

Concept of Values and Value Education; Historical Background of Value Education Aims and Objectives of Value Education Need, Importance and Role of Value Education in the present emerging Indian society Classification of Values

Unit II Theories & Model of Value Development

Theories of Value Development: Psycho-analytic, Learning theory – social learning Cognitive development , Piaget an Kohlberg Models of Value Development : Value Analysis, Rationale Building, Social Action , The Consideration Model

Unit III Types of Values & Profession

Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity. Professional Values-Knowledge thirst, sincerity in profession, regularity, punctuality and faith. Religious Values - Tolerance, wisdom, character. Modernity vs. Value crisis, Issues and challenges Value orientation of Teacher education curricula in India

Unit IV Value & Character Building

Concept of Morality and Moral Judgment Aspects of Moral Education – Liberal, Social, Religious, Psychological Development of Moral Character And Attitude Role of Media in developing values and morality

UINT V Transactional Strategies

Discussions, lectures, debates, workshops, conduct of various speeches and talks .

Course Outcomes:

After successful completion of this course the students will be able to:

1. Understand importance and need for value education
2. Appreciate various activities organized by the schools to develop desirable values in the students
3. Conduct various talks and programs for value education
4. Gain knowledge of various models for value education
5. Understand role of teachers for inculcation of values in the students

TEXT BOOKS:

1. Josta,H.R.(1991).Spiritual values and education. Ambala Cantt: Associated Publishers.
2. Kluckhokhn, C.(1961). The Study of Values. In D.N. Barett (ed), value in America. Norte Dame:University of Norte Dame Press.

REFERENCE BOOKS:

1. Kothari D.S. Education and Values, Report of the orientation course-cum-workshop on Education in Human Values. New Delhi.
2. Malhotra P.L. Education, Social Values and Social Work-the Task for the New Generation, New Delhi: N.C.E.R.T..
3. Morris, Charles (1956). Varieties of human values. Chicago: University of Chicago press.
4. Mukerjee, R.K., (1969). Social structure of values. New Delhi: S. Chand and Co.
5. NCERT (1992).Education in values, New Delhi.