R20 M.TECH CAD/CAM

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY & MANAGEMENT
(Affiliated to JNTU, Hyderabad, Approved by AICTE, New Delhi)
Accredited by NBA, Accredited by NAAC with 'A' Grade & Recognized Under section 2(f) & 12(B) of the UGC act, 1956
Dundigal (Vill .& Mandal), Medchal District, Hyderabad - 500043, Telangana.

(UGC Autonomous)

M.Tech in CAD/CAM

Course Structure and Syllabus (R20)

Applicable From 2020-2021 Admitted Batch

I YEAR - I SEMESTER

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C	Scheme of Examination Maximum Marks		
THEORY							**Internal (CIE)**	**External (SEE)**	**Total**
1.	CORE-1	Advanced CAD	3	0	0	3	30	70	100
2.	CORE-2	Advanced CAM	3	0	0	3	30	70	100
3.	PE-1	1.Atomation in Manufacturing 2.Computer Aided Processes Planning 3.Performance Modeling and Analysis of Manufacturing Systems	3	0	0	3	30	70	100
4.	PE-2	1.Mechanical Behavior of Materials 2.Stress Analysis and Vibration 3.Additive Manufacturing Technologies	3	0	0	3	30	70	100
5.	MC	Research Methodology and IPR	2	0	0	2	30	70	100
6.	AC	Audit Course-I	2	0	0	0	30	70	100
PRACTICAL									
7.	LAB-1	Advanced Cad Laboratory	0	0	4	2	30	70	100
8.	LAB-2	Computer Aided Engineering Laboratory	0	0	4	2	30	70	100
TOTAL			**16**	**0**	**8**	**18**	**240**	**560**	**800**

R20 M.TECH CAD/CAM

I YEAR II – SEMESTER

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C	Scheme of Examination Maximum Marks		
THEORY							**Internal (CIE)**	**External (SEE)**	**Total**
1.	CORE-3	Design for Manufacture, Assembly and Environments	3	0	0	3	30	70	100
2.	CORE-4	Advanced Engineering Materials	3	0	0	3	30	70	100
3.	PE-3	1. Advanced Tool Design 2. Advanced Manufacturing Process 3.Optimization Techniques and Applications	3	0	0	3	30	70	100
4.	PE-4	1. Design of Hydraulic and Pneumatic Systems 2. Metrology and Non Destructive Testing 3. Mechanics of Composite Materials	3	0	0	3	30	70	100
5.	CORE-5	Mini Project With seminar	0	0	4	2	30	70	100
6.	AC	Audit Course-II	2	0	0	0	30	70	100
PRACTICAL									
7.	LAB-3	Simulation of Manufacturing Systems Laboratory	0	0	4	2	30	70	100
8.	LAB-4	Advanced material Laboratory	0	0	4	2	30	70	100
TOTAL			**14**	**0**	**12**	**18**	**240**	**560**	**800**

R20 M.TECH CAD/CAM

II YEAR I – SEMESTER

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C	Scheme of Examination Maximum Marks		
THEORY							**Internal (CIE)**	**External (SEE)**	**Total**
1.	PE-5	1. Advanced Finite Element Method in Manufacturing Engineering. 2. Industrial Robotics. 3. Flexible Manufacturing Systems	3	0	0	3	30	70	100
2.	OE	1. Business Analytics 2. Industrial Safety 3. Energy from Waste	3	0	0	3	30	70	100
PRACTICAL									
3.	Dissertation	Dissertation Phase – I	0	0	20	10	100	0	100
TOTAL			**6**	**0**	**20**	**16**	**160**	**140**	**300**

II YEAR II SEMESTER

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C	Scheme of Examination Maximum Marks		
PRACTICAL							**Internal (CIE)**	**External (SEE)**	**Total**
1.	Dissertation	Dissertation Phase – II	0	0	32	16	100	100	200
TOTAL			**0**	**0**	**32**	**16**	**100**	**100**	**200**

R20 M.TECH CAD/CAM

Audit Course -I		
S.No	**Course Code**	**Course**
1	AC 1	English for Research Paper Writing
2	AC 2	Disaster Management
3	AC 3	Sanskrit for Technical Knowledge
4	AC 4	Value Education

Audit Course -II		
S.No	**Course Code**	**Course**
1	AC 5	Constitution of India
2	AC 6	Pedagogy Studies
3	AC 7	Stress Management by yoga
4	AC 8	Personality Development Through Life Enlightenment Skills

M.Tech – (I Year & I Sem)

ADVANCED CAD

SUBJECT CODE: CORE 1 **L T P C**

3 0 0 3

COURSE OBJECT :

- This course aims at imparting knowledge on computer applications in design.
- To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Describe** the Surface Modeling techniques such as interpolation and approximation
- **Relate** Graphics and computing standards
- **Assemble** and modeling various mechanical components
- **Analysis** of various types of fits and tolerances
- **Categorize** the capabilities of modeling and analysis packages such as solid works, Pro-E and ANSYS.

UNIT – 1 INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 9

Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation

UNIT – 2 CURVES AND SURFACES MODELING 9

Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.

Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface-surface manipulations.

UNIT – 3 NURBS AND SOLID MODELING 9

NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations – constructive solid Geometry - comparison of representations - user interface for solid modeling.

UNIT – 4 VISUAL REALISM 9

Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages

UNIT – 5 ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

Assembly modeling - interferences of positions and orientation - tolerances analysis – mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards.

TOTAL PERIODS: 45

TEXT BOOK :

1. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992.
2. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.

REFERENCE BOOK :

1. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.

M.Tech – (I Year & I Sem)

ADVANCED CAM

SUBJECT CODE: CORE 2 **L T P C**

3 0 0 3

COURSE OBJECT :

The course should enable the students to:

- Develop an understanding of the advanced aspects of enabling computer aided technologies used in design, engineering, manufacturing and rapid product development
- Develop a degree of ability in the development and application of modern CAD/CAM system.
- Apply knowledge on advances in modern techniques of rapid prototyping and rapid tooling

COURSE OUTCOMES :

At the end of the course student should be able to

1. Explain about APT programming and tool path generation.
2. Discuss in detail about tooling system, DNC and adaptive control.
3. Explain post processes required for CNC.
4. Explain computer aided process planning and its types.

UNIT – 1 COMPUTER-AIDED PROGRAMMING 9

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

UNIT – 2 TOOLING FOR CNC MACHINES 9

Interchangeable tooling system, preset and qualified toois, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

UNIT – 3 POST PROCESSORS FOR CNC 9

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

UNIT – 4 MICRO CONTROLLERS 9

Introduction, Hardware components, I/O pins, ports, external memory:, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications, and Programming of Micro Controllers. Programming Logic Controllers (PLC' s):Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT – 5 COMPUTER AIDED PROCESS PLANNING 9

: Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

TOTAL PERIODS: 45

TEXT BOOK :

1. P.N. Rao, N. K. Tewari, T K Kundra " Computer Aided Manufacturing" McGraw Hill
2. CAD/CAM Principles and Applications, P.N. Rao, TMH.

REFERENCE BOOK :

1. Computer Control of Manufacturing Systems / Yoram Koren / McGraw Hill. 1983.
2. CAD / CAM / CIM, Radha krishnan and Subramanian, New Age
3. CAD/CAM Design and manufacturing, Groover, McGraw Hill.

M.Tech – (I Year & I Sem)

AUTOMATION IN MANUFACTURING

SUBJECT CODE: P E-1

L	T	P	C
3	0	0	3

COURSE OBJECT :

The course should enable the students to:

- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems.
- Illustrate adaptive control systems and automated inspection methods.

COURSE OUTCOMES :

Upon completion of this course the student will be able to:

1. Illustrate the basic concepts of automation in machine tools.
2. Analyze various automated flow lines, Explain assembly systems and line balancing methods.
3. Describe the importance of automated material handling and storage systems.
4. Interpret the importance of adaptive control systems, automated inspection systems.

UNIT – 1 OVER VIEW OF MANUFACTURING AND AUTOMATION 09

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

UNIT – 2 MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES 09

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

UNIT – 3 MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES 09

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

UNIT – 4 AUTOMATED ASSEMBLY SYSTEMS 09

Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – 5 QUALITY CONTROL AND SUPPORT SYSTEMS 09

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

TOTAL PERIODS: 45

TEXT BOOK :

1. Automation, production systems and computer integrated manufacturing/ Mikell.P Groover/PHI/3rd edition/2012.
2. Automation, Production Systems and CIM/ MikeJ P. Grower/PHI

REFERENCE BOOK :

1. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/New Age International Publishers/2003.
2. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/2009

M.Tech – (I Year & I Sem)

COMPUTER AIDED PROCESS PLANNING

SUBJECT CODE: P E -1 **L T P C**

3 0 0 3

COURSE OBJECT :

The course should enable the students to:

- understand what is process planning and CAPP,
- know the various steps involved in CAPP,
- classify the various methods of CAPP,
- understand the feature recognition in CAPP

COURSE OUTCOMES :

At the end of the course students should be able to

1. Understand CAPP, its features and advantages.
2. Explain principles Of generative CAPP systems and knowledge based systems
3. Explain retrieval CAPP system and selection of manufacturing sequence.
4. Determine various machining parameters.
5. Explain tool path generation and implementation of various techniques for CAPP.

UNIT – 1 **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 – 2 **Part Design Representation:** **9**

Design Drafting-Dimensioning-Conventional Tolerance- Geometric Tolerance-CAD-input/output devices-Topology - Geometric transformation-Perspective transformation-Data Structure-Geometric modeling for process planning--GT Coding-The OPITZ system-The MICLASS System

UNIT – 3 **Process Engineering and Process Planning** **9**

Experience based planning-Decision table and Decision trees-Process capability analysis-Process planning-Variant process planning-Generative approach-Forward and backward planning, Input format, AI.

UNIT – 4 **Computer Aided Process Planning Systems** **9**

Logical Design of process planning- Implementation considerations-Manufacturing system components, Production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT – 5 **An Integrated Process Planning Systems** **9**

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

TOTAL PERIODS: 45

TEXT BOOK :

1. Gideon Halevi and Roland D. Weill, "Principle of process planning- A Logical Approach", Chapman & Hall, 1995.
2. Chang T. C. & Richard A.Wysk, "An Introduction to automated process planning systems", Prentice Hall 1985

REFERENCE BOOK :

1. Chang, T.C., "An Expert Process Planning System", Prentice Hall, 1985
2. Rao P.N., "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co., 2000.

M.Tech – (I Year & I Sem)

PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

SUBJECT CODE: P E - 1 **L T P C**

3 0 0 3

COURSE OBJECT :

- This course aims at imparting knowledge on modeling and analysis of manufacturing system.
- To develop the manufacturing system control technics
- To develop the new manufacturing process control

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Explain the** Quality, Control Systems
- **Derive the** Equations for CTMC evolution
- **Analyze** the flexible machine center
- **Compose the** Generalized Stochastic Petri Net
- **Arrange** the cards for KAMBAN system**.**

UNIT – 1 MANUFACTURING SYSTEMS & CONTROL 9

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

UNIT – 2 MANUFACTURING PROCESSES 9

Examples of stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs in manufacturing – Chapman – Kolmogorov equation – Steady-state analysis. Continuous Time Markov Chain Models – Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing – Equations for CTMC evolution – Markov model of a transfer line. Birth and Death Processes in Manufacturing – Steady state analysis of BD Processes – Typical BD processes in manufacturing.

UNIT – 3 **QUEUING MODEL** **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 – 4 **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 – 5 **PETRINETS** **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 – modeling of KANBAN systems – Manufacturing models.

TOTAL PERIODS: 45

TEXT BOOK :

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

REFERENCE BOOK :

1. Gupta S.C., Kapoor V.K, "Fundamentals of Mathematical Statistics ", Sultan Chand and Sons, 3rd Edition, New Delhi, 1988.
2. Viswanadham, N, Narahari, Y, "Performance Modelling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi, 1994.

M.Tech – (I Year & I Sem)

MECHANICAL BEHAVIOR OF MATERIALS

SUBJECT CODE: P E - 2 **L T P C**

3 0 0 3

COURSE OBJECT :

- This course aims at imparting knowledge on mechanical behavior of materials

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Explain** the basic concept of stresses
- **Describe** the true stress and true strain
- **Analyze** the properties composite high strength low alloy steel
- **Summarize** the modern metallic materials.
- **Explain the** application nonmetallic materials

UNIT – 1 BASIC CONCEPTS OF STRESS 9

Definition, State of Stress at a point, Stress tensor, invariants of stress tensor, principle stresses, stress ellipsoid, derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, Deviatoric and Hydrostatic components of stress, Invariance of deviatoric stress tensor, plane stress.

UNIT – 2 TRUE STRESS AND TRUE STRAIN 9

von-Mises and Tresca yield criteria, Haigh–Westergard stress space representation of von - Mises and Tresca yield criteria, effective stress and effective strain, St. Venants theory of plastic flow, Prandtle–Reuss and Levy–Mises constitutive equations of plastic flow, Strain hardening and work hardening theories, work of plastic deformation.

UNIT – 3 MICROMECHANICS OF COMPOSITES 9

Introduction about composites Mechanical properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT – 4 MODERN METALLIC MATERIALS 9

Dual phase steels, High strength low alloy steel, Transformation induced plasticity Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT – 5 NON METALLIC MATERIALS 9

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

TOTAL PERIODS: 45

TEXT BOOK :

1. George E.Dieter, "Mechanical Metallurgy", McGraw Hill,1988.
2. Thomas H. Courtney, "Mechanical Behavior of Materials", McGraw Hill, 2nd edition, 2000.
3. Charles J.A., Crane F.A.A. and Furness J.A.G, "Selection and use of Engineering Materials", Third Edition, Butterworth – Heiremann, 1997.
4. Flinn R.A. and Trojan P.K, "Engineering Materials and their Applications",4th Edition, Jaico, 1999.

REFERENCE BOOK :

1. Ashby M.F, "materials selection in Mechanical Design", Butter worth, 2nd Edition, 1999.
2. Timoshenko and Goodieer, "Theory of Elasticity", Mcgraw Hill Publications, 3rd Edition.
3. Madleson, "Theory of Plasticity".
4. Chakrabarty.J, "Theory of Plasticity", 2nd Edition, McGraw Hill, 1998.
5. Metals Hand book, "Failure Analysis and Prevention" 10th Edition, jaico, 1999.

M.Tech – (I Year & I Sem)

STRESS ANALYSIS AND VIBRATION

SUBJECT CODE: P E - 2 **L T P C**

3 0 0 3

COURSE OBJECT :

- Variational Principles interpreted in terms of projections in computational subspaces.
- How FE strains occur as best fits at the element level.
- Pathological problems; Shear Locking in Timoshenko beam elements.
- How reduced integration and an-isoperimetric formulations eliminate locking problems.
- Geometrical patterns in Errors in Elastodynamic Analysis using FE.
- To understands the Fundamentals of Vibration and its practical applications.
- To understand the working principle and operations of various vibrations measuring instruments.

COURSE OUTCOMES :

- To Provides knowledge about different experimental stress analysis techniques and to develop schematic models for physical systems and formulate governing equations
- To analyze rotating and reciprocating systems and design machine supporting structures,
- To describe the fundamentals of vibrations and to analyze the damped motion without external force for under damped, over damped and critically damped motion.
- Determine the natural frequencies and mode shapes of different two degree and multi degree freedom systems
- Calculate free and forced vibration responses of multi degree freedom systems using modal analysis.

UNIT – 1 ELASTICITY THEORY 9

Two dimensional elasticity theory in Cartesian coordinates, plane stress problem in polar coordinates Thick cylinders, Rotating discs - stress concentration.

UNIT – 2 TORSION 9

Torsion of non circular prismatic sections, rectangular and axisymmetric, Circular plates, introduction to shell theory — contact stresses.

UNIT – 3 FREE AND FORCED VIBRATIONS 9

Single degree freedom, two degree freedom system without and with damping - Free and forced vibrations. Transient vibrations.

UNIT – 4 **TRANSIENT VIBRATIONS** **9**

Transient vibrations of single and two degree freedom systems, multi-degree of freedom systems - applications of matrix methods , continuous systems.

UNIT – 5 **VIBRATIONS OF STRINGS BARS AND BEAMS** **9**

Free and forced vibrations of strings bars and be CAD/CAM. Principle of orthogonality - classical and energy methods.

TOTAL PERIODS: 45

TEXT BOOK :

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. Mechanical Vibrations/ Gorge G K, new age.

REFERENCE BOOK :

1. Theory of machine, kurmi R S, chand publication.

M.Tech – (I YEAR & I SEM)

ADDITIVE MANUFACTURING TECHNOLOGIES

SUBJECT CODE: P E - 2 **L T P C**

PRE REQUESTS: Manufacturing Process **3 0 0 3**

COURSE OBJECT :

- To provide in depth knowledge in different types of Rapid Prototyping systems and their applications in various fields.
- Understand the need of digital fabrication.
- Understand about Two dimensional layer by layer techniques.
- Know about extrusion based systems, post processing and the software issues involved in digital fabrication.
- Know the applications of digital fabrication.
- To design and generate supporting structures for critical components.

COURSE OUTCOMES :

- This course would make familiar of basic concepts in Rapid Prototyping, its development and applications.
- Course would be helpful to understand the basic principle behind different types of Rapid Prototyping systems.
- Students would be trained to find innovative solutions for designing of supporting structures and to use standard practices.
- One would be able to make use of a suitable Rapid Prototyping technique for a component after analyzing its design requirements, structural strength and functionality.
- Summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
- Summarize typical rapid tooling processes for quick batch production of plastic and metal parts.

UNIT – 1 INTRODUCTION 09

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

UNIT – 2 LIQUID BASED ADDITIVE MANUFACTURING SYSTEMS 0 9

Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – 3 SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 0 9

Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – 4 POWDER BASED ADDITIVE MANUFACTURING SYSTEMS 09

Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Process, materials, products, advantages, limitations and applications– Case Studies.

UNIT – 5 OTHER RAPID PROTOTYPING TECHNOLOGIES 09

Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Shape Deposition Manufacturing (SDM): Introduction, basic process, shape decomposition, Mould SDM and applications. Selective Laser Melting, Electron Beam Melting – Rapid manufacturing.

TOTAL PERIODS: 45

TEXT BOOK :

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2003.
2. Ali K. Kamrani, Emad Abouel Nasr, "Rapid Prototyping: Theory and practice", Springer, 2006.
3. Liou W.Liou, Frank W.Liou, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.

REFERENCE BOOK :

1. D.T. Pham and S.S. Dimov, Rapid Manufacturing, Springer.
2. PaulF.Jacobs, Rapid Prototyping and Manufacturing, ASME.
3. Peter D.Hilton, Hilton/Jacobs, Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.
4. Andreas Gebhardt, Hanser. "Rapid prototyping", Gardener Publications, 2003.

M.Tech – (I Year & I Sem)

RESEARCH METHODOLOGY AND IPR	L	T	P	C
	3	0	0	3

OBJECTIVES:

- To provide an overview on selection of research problem based on the Literature review
- To enhance knowledge on the Data collection and Analysis for Research design
- To outline the importance of ethical principles to be followed in Research work and IPR

COURSE OUTCOMES:

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

- Identify and Formulate the Research Problem
- Collect and Analyze data from various sources of Literature.
- Write thesis effectively including technical reports and other contents.
- Explain the ethical principles to be followed while patenting or obtaining copyright.

Apply for patent rights and demonstrate New developments in IPR

UNIT I INTRODUCTION TO PROJECT FORMULATION 9

Meaning of research problem, Sources of research problem, Criteria, Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis

UNIT II DATA COLLECTION, ANALYSIS AND ETHICS 9

Execution of the research - Observation and Collection of data - Methods of data collection Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation - Plagiarism, Application of results and ethics - Environmental impacts - Ethical issues - ethical committees

UNIT III REPORT,THESIS, PAPER AND RESEARCH PROPOSAL WRITING 9

Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes, how to write report- Paper Developing a Research Proposal- Format of research proposal- a presentation and assessment by a review committee

UNIT IV INTELLECTUAL PROPERTY 9

Nature of Intellectual Property - Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR 9

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: 45 PERIODS

TEXT BOOK

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

REFERENCE BOOK

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications

ADVANCED CAD LABORATORY

(Lab - I)

L	T	P	C
0	0	4	2

1. Two- dimensional drawing using CAD software.
2. Three-dimensional drawing using CAD software.
3. Various Dimensioning and tolerance techniques on typical products using CAD software.
4. Assembly and animation of simple assemblies like screw jack, bolt-nut mechanism, etc.
5. Truss analysis using FEA software.
6. Beam analysis using FEA software.
7. Frame analysis using FEA software.
8. Buckling analysis of columns using FEA software.
9. Harmonic analysis using FEA software.
10. Fracture analysis using FEA software.
11. Analysis of laminated composites using FEA software.
12. Couple-field analysis using FEA software.
13. Modal Analysis
14. Transient dynamic analysis.
15. Spectrum analysis.

ADVANCED CAM LABORATORY

(Lab - II)

L T P C

0 0 4 2

List of Experiments:

1. CNC programs for turning- 4 exercises
2. CNC programs for milling- 4 exercises
3. Robot programming- Lead through programming using teach product, forward kinematics, inverse kinematics, trajectory planning.

M.Tech – (I Year & II Sem)

DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS

SUBJECT CODE: CORE 3 **L T P C**

3 0 0 3

COURSE OBJECT :

- To Design for Manufacture, Assembly and Environments is to create new and better ideas and improving the existing one
- To analyze and Redesign the component by the influence of man, machine, material and process.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Arrange** the Geometric tolerances
- **Discus** the minimize moulding core requirement
- **categorize** of materials on form design
- **Identify** the different part family in group technology

  Assess the Techniques to reduce environmental impact

UNIT – 1 INTRODUCTION 08

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits - Datum features - Tolerance stacks

UNIT – 2 FACTORS INFLUENCING FORM DESIGN 09

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT – 3 COMPONENT DESIGN - MACHINING CONSIDERATION 10

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area - simplification by separation - simplification by amalgamation – Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly**.**

UNIT – 4 COMPONENT DESIGN - CASTING CONSIDERATION 09

Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA.

UNIT – 5 DESIGN FOR THE ENVIRONMENT 09

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

TOTAL PERIODS: 45

TEXT BOOK :

1. Boothroyd G, "Design for Assembly Automation and Product Design", Marcel Dekker, New York, 1980.
2. Boothroyd, G, Heartz and Nike, "Product Design for Manufacture", Marcel Dekker, 1994.

REFERENCE BOOK :

1. Dickson, John. R and Corroda Poly, "Engineering Design and Design for Manufacture and Structural Approach", Field Stone Publisher, USA, 1995.
2. Fixel, J, "Design for the Environment ", McGraw hill, 1996.

M.Tech – (I Year & II Sem)

ADVANCED ENGINEERING MATERIALS

SUBJECT CODE: CORE 4 **L T P C**

3 0 0 3

COURSE OBJECT :

- To provide knowledge in the areas of characterization of materials
- To impart knowledge on selection of materials for important applications

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Summarize** the behavior of materials under different loading conditions
- **Select** appropriate material for the application concerned
- **Apply** the modern materials
- **Describe** the deferent types of ceramics

  Describe the Relationship between materials selection and processing

UNIT – 1 PLASTIC BEHAVIOUR & STRENGTHENING
08

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 – 2 FRACTURE BEHAVIOUR
08

Griffith's theory stress intensity factor and fracture toughness-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 – 3 CHARACTERIZATION OF MATERIALS
10

X-ray diffraction, Crystallography basics, characteristic spectrum, Bragg's law, Diffraction methods – Lauer, rotating crystal and powder methods. Optical microscopy, Construction and operation of Transmission electron microscope – Selected Area Electron Diffraction and image formation, specimen preparation techniques Scanning electron microscopy, Transmission electron microscopy, Atomic force microscope, thermal analysis techniques.

UNIT – 4 MATERIAL TESTING & SELECTION OF MATERIALS 09

Tension, Hardness, torsion, bending, fracture and impact tests. Motivation for selection of materials , cost basis and service requirements – selection for Mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with Relevance to aero, auto, marine, machinery and nuclear applications.

UNIT – 5 MODERN MATERIALS AND TREATMENT 10

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 PERIODS: 45

TEXT BOOK :

1. George E. Dieter, "Mechanical Metallurgy", McGraw Hill,1988.
2. Charles J.A, Crane F.A.A. and Furness J.A.G, "Selection and use of Engineering Materials ", Third Edition, Butterworth – Heiremann, 1997.

REFERENCE BOOK :

1. Brandon D. G, "Modern Techniques in Metallography", Von Nostrand Inc NJ, USA, 1986.
2. Tadeu Z Burakowski, Tadenz. Wierzchon, "Surface Engg of Metals", Principles, Equipment, Technlogies, CRC press, 1998.

M.Tech – (I Year &II Sem)

ADVANCED MANUFACTURING PROCESS

SUBJECT CODE: P E - 3 **L T P C**

3 0 0 3

COURSE OBJECT :

- To impart the principles of various basic micro manufacturing process.
- The objective of the course is to acquaint the students with the principles, basic machine tools, and developments in the micro manufacturing process and research trends in the area of micro manufacturing process.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- Understand the concept of AWJM, AJM, Chemical and Electro Chemical Machining Process.
- Describe the concept of beam energy micro machining.
- Explain various types of micro polishing method.
- Analysis of various types of micro forming and welding process
  Understand various types application in micro manufacturing process.

UNIT – 1 MICRO MACHINING I 10

Mechanical Micro machining – Ultra Sonic Micro Machining – Abrasive Jet Micro Machining – Water Jet Micro Machining – Abrasive Water Jet Micro Machining – Micro turning – Chemical and Electro Chemical Micro Machining – Electric discharge micro machining.

UNIT – 2 MICRO MACHINING II 10

Beam Energy based micro machining – Electron Beam Micro Machining – Laser Beam Micro Machining – Electric Discharge Micro Machining – Ion Beam Micro Machining –Plasma Beam Micro
Machining – Hybrid Micro machining – Electro Discharge Grinding – Electro Chemical spark micro
machining – Electrolytic in process Dressing

UNIT – 3 NANO POLISHING 09

Abrasive Flow finishing – Magnetic Abrasive Finishing – Magneto rheological finishing – Magneto Rheological abrasive flow finishing - Magnetic Float polishing – Elastic Emission Machining – chemomechanical Polishining.

UNIT – 4 MICRO FORMING AND WELDING 09

Micro extrusion – Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting – Micro bending with LASER – LASER micro welding – Electron beam for micro welding.

UNIT – 5 RECENT TRENDS AND APPLICATIONS 07

Metrology for micro machined components – Ductile regime machining– AE based tool wear compensation– Machining of Micro gear, micro nozzle, micro pins – Applications

TOTAL PERIODS: 45

TEXT BOOK:

1. Jain V. K., Micro Manufacturing Processes, CRC Press, Taylor & Francis Group, 2012
2. Jain V.K., 'Introduction to Micro machining' Narosa Publishing House, 2011

REFERENCE BOOK :

1. Jain V.K., Advanced Machining Processes, Allied Publishers, Delhi, 2002
2. Mcgeoug.J.A., Micromachining of Engineering Materials, CRC press 2001, ISBN-10:0824706447.

M.Tech – (I Year & II Sem)

ADVANCED TOOL DESIGN

SUBJECT CODE: P E - 3 **L T P C**

3 0 0 3

COURSE OBJECT :

- This course aims at imparting knowledge on advanced tool design

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Select** the materials for cutting tools
- **Explain about the** Oblique and orthogonal cutting
- **Describe** the design procedure for jig .
- **Calculate the** Clearance and cutting force of press die.
  List out the tool holding methods.

UNIT – 1 INTRODUCTION TO TOOL DESIGN 08

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives –Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials-Carbides, Ceramics and Diamond –Non metallic tool materials-Designing with relation to heat treatment.

UNIT – 2 DESIGN OF CUTTING TOOLS 09

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools-Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

UNIT – 3 DESIGN OF JIGS AND FIXTURES 10

Introduction – Fixed Gages – Gage Tolerances –selection of material for Gages –Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Thrust and Turning Moments in drilling - Drill jigs and modern manufacturing- Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Modular Fixtures – Cutting Force Calculations.

UNIT – 4 DESIGN OF PRESS TOOL DIES 10

Types of Dies –Method of Die operation–Clearance and cutting force calculations-Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies Drawing dies-Design and drafting

UNIT – 5 DESIGN FOR CNC MACHINE TOOLS 08

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine

TOTAL PERIODS: 45

TEXT BOOK :

1. Cyrll Donaldson, George H.LeCain and, Goold V.C, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2. Hoffman E.G, "Jig and Fixture Design", Thomson Asia Pvt Ltd., Singapore, 2004.

REFERENCE BOOK :

1. Venkataraman K, "Design of Jigs, Fixtures and Press tools", TMH, 2005.
2. Haslehurst M, "Manufacturing Technology", the ELBS, 1978

M.Tech – (I Year & II Sem)

OPTIMIZATION TECHNIQUES AND APPLICATIONS

SUBJECT CODE: P E - 3 **L T P C**

3 0 0 3

COURSE OBJECT :

- This course aims at imparting knowledge on various optimization techniques.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- Apply the optimization techniques in various problems
- Formulate the Optimization with equality and inequality constraints
- Design the simple truss members
- Discuss the Application linkage Mechanisms
- Describe the various steps involved in GA.

UNIT – 1 UNCONSTRAINED OPTIMIZATION TECHNIQUES 09

Introduction to optimum design - General principles of optimization – Problem formulation & their classifications - Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT – 2 CONSTRAINED OPTIMIZATION TECHNIQUES 09

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming.

UNIT – 3 ADVANCED OPTIMIZATION TECHNIQUES 09

Multi stage optimization – dynamic programming; stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques; Neural network and Fuzzy logic principles in optimization.

UNIT – 4 STATIC APPLICATIONS 09

Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs.

UNIT – 5 DYNAMIC APPLICATIONS 09

Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

TOTAL PERIODS: 45

TEXT BOOK :

1. Rao, Singaresu, S, "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C, "Optimum design of mechanical elements", Wiley, John & Sons, 1990.

REFERENCE BOOK :

1. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples ", Prentice Hall of India Pvt, 1995.
2. Goldberg, D.E, "Genetic algorithms in search, optimization and machine", Barnen,Addison-Wesley, New York, 1989.

M.Tech – (I Year & II Sem)

DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

SUBJECT CODE: P E - 4 **L T P C**

3 0 0 3

COURSE OBJECT :

- To know about the Hydraulic and pneumatic systems used in industries
- To learn about the installation and maintenance of hydraulic and pneumatic systems.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Illustrate the** specification, characteristics, and selection of pumps and accelerators
- **Explain** the application and working principles of valves
- **Design the** hydraulic circuit for real time applications
- **Design** the pneumatic circuit for real time applications**.**

Describe about the illustration and maintenance of circuits

UNIT – 1 OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 09

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

UNIT – 2 CONTROL AND REGULATION ELEMENTS 08

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

UNIT – 3 HYDRAULIC CIRCUITS 10

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 – 4 PNEUMATIC SYSTEMS AND CIRCUITS 09

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

UNIT – 5 INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 09

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 PERIODS: 45

TEXT BOOK :

1. Antony Espossito, "Fluid Power with Applications", Prentice Hall, 1980.
2. Dudleyt, A. Pease andJohn J. Pippenger, "Basic fluid power", Prentice Hall, 1987.

REFERENCE BOOK :

1. Bolton. W, "Pneumatic and Hydraulic Systems", Butterworth – Heinemann, 1997.
2. K.Shanmuga Sundaram, "Hydraulic and Pneumatic Controls: Understanding made Easy " S. Chand and Co Book publishers, New Delhi, 2006.
3. Majumithar, Pneumatics systems principles and maintenance, Tata mchill.

M.Tech – (I Year & II Sem)

MECHANICS OF COMPOSITE MATERIALS

SUBJECT CODE: P E - 4 **L T P C**

3 0 0 3

COURSE OBJECT :

The course should enable the students to:

- An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
- An ability to predict the elastic properties of both long and short fiber composites based on the constituent properties.
- An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra.

COURSE OUTCOMES :

Upon successful completion of this course, the student will be able to

1. Identify and explain the types of composite materials and their characteristic features.
2. Understand the differences in the strengthening mechanism of composite and its corresponding.
3. Effect on performance and application.
4. Understand and explain the methods employed in composite fabrication.
5. Learn simple micromechanics and failure modes of composites.

UNIT – 1 INTRODUCTION TO COMPOSITE MATERIALS 09

Introduction, classification, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

REINFORCEMENTS: Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT – 2 MANUFACTURING METHODS 09

Autoclave, tape production, moulding methods, filament winding, Hand lay up, pultrusion, RTM, Stirr casting.

UNIT – 3 ENGINEERING MECHANICS ANALYSIS AND DESIGN 09

concepts of isotropy vs. anisotropy, composite micromechanics (effective stiffness/strength predictions, load-transfer mechanisms), Classical Lamination Plate theory (CLPT).

UNIT – 4 PROPERTIES AND PERFORMANCE OF COMPOSITES 09

Properties and microstructure of high-strength fiber materials (glass, carbon, polymer, ceramic fibers) and matrix materials (polymer, metal, ceramic, and carbon matrices). Specific strength and stiffness of high-performance composites. Rule of mixtures. Stress, strain transformations.

UNIT – 5 **FAILURE CRITERIA** **09**

Hygrothermal stresses, bending of composite plates, analysis of sandwich plates, buckling analysis of laminated composite plates, inter-laminar stresses, First Order Shear Deformation Theory (FSDT).

TOTAL PERIODS: 45

TEXT BOOK :

1. Principles of Composite Material Mechanics, Fourth EditionBy Ronald F. Gibson
2. Introduction to Composite Materials Design, Third EditionBy Ever J. Barbero.

REFERENCE BOOK :

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975
2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
3. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley-Interscience, New York, 1980.

M.Tech – (I Year & II Sem)

METROLOGY AND NON DESTRUCTIVE TESTING

SUBJECT CODE: P E - 4 **L T P C**

3 0 0 3

COURSE OBJECT :

- To introduce different types of sensors, transducers and strain gauges used for Measurement.
- To give knowledge about Statistical measures and tools
- To familiarize students with non-destructive testing on machine components.

COURSE OUTCOMES :

After successful completion of this course, the Students will be able to

- **Identify** the sensors and transducers used for stress analysis.
- **Apply** the Control charts for variables and for fraction defectives.
- **Explain** the Principles of operation of magnetic particle test.
- **Review the** different types of waves.
- **List** out the benefits and limitation of acoustic emission techniques.

UNIT – 1 MEASURING MACHINES 09

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 – 2 STATISTICAL QUALITY CONTROL 09

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 – 3 LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS 09

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 – 4 RADIO GRAPHY 09

Sources of ray-x-ray production - properties of d and x rays - film characteristics -exposure charts - contrasts - operational characteristics of x ray equipment -applications.

UNIT – 5 ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 09

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 PERIODS: 45

TEXT BOOK :

1. Jain R.K, "Engineering Metrology", Khanna Publishers, 1997.
2. Barry Hull and Vernon John, "Non Destructive Testing", MacMillan, 1988.

REFERENCE BOOK :

1. American Society for Metals, "Metals Hand Book", 1976.

SIMULATION OF MANUFACTURING SYSTEMS LABORATORY

(Lab - 3)

L T P C

0 0 4 2

SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

ANALYSIS

1. Structural analysis of Piston using ANSYS Workbench.
2. Structural Analysis of a Cantilever Using ANSYS Workbench
3. Structural Analysis of Simply Supported Beam Using ANSYS Workbench
4. Thermal analysis of Disc Brake using ANSYS Workbench
5. Thermal analysis of Piston using ANSYS Workbench

ADVANCED MATERIAL LABORATORY

(Lab - 4)

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.

2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.

3. Grain size measurement by different methods.

4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.

5. Study of the Microstructures of Cast Irons.

6. Study of Microstructures of different alloy steels.

7. Study of the Microstructures of Non-Ferrous alloys.

8. Study of the Microstructures of Heat treated steels.

9. Hardenability of steels by Jominy End Quench Test.

10. To find out the hardness of various heat treated and untreated plain carbon steels.

MINI PROJECT WITH SEMINAR

L T P C
0 0 4 2

DESCRIPTION:

This course is introduced to enrich the communication skills of the student and to create awareness on recent development in Electrical and Electronics Engineering through Technical presentation. In this course, a student has to present at least two Technical papers or recent advances in Engineering / Technology that will be evaluated by a Committee constituted by the Head of the Department.

Students should work on a small research problem. Students have to carry out the project under the guidance of faculty member using the knowledge of subjects that he/she has learned. The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination.

ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course – I)

M. Tech – (I YEAR & I SEM)	L	T/P	C
	2	0/0	0

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-V:

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

DISASTER MANAGEMENT
(Audit Course - I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives: Students will be able to

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- Planning and programming in different countries, particularly their home country or the countries they working.

UNIT-I:

Introduction:

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT-II:

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

UNIT-V:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal bookCompany.
2. Sahni, PardeepEt. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, NewDelhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., NewDelhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit Course - I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:

Alphabets in Sanskrit.

UNIT-II:

Past/Present/Future Tense, Simple Sentences.

UNIT-III:

Order, Introduction of roots.

UNIT-IV:

Technical information about Sanskrit Literature.

UNIT-V:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

VALUE EDUCATION
(Audit Course - I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge ofs elf-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles. Value judgments

UNIT-II:

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT-III:

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

Avoid fault Thinking. Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship. Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation. Doing best for saving nature

UNIT-V:

Character and Competence –Holy books vs Blind faith, Self-management and Good health' Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, Allreligions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS/ REFERENCES:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, NewDelhi