### I SEMESTER

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM11A</td>
<td>Core Course- I</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced CAD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GM11B</td>
<td>Core Course- II</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Computer Aided Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GM11C</td>
<td>Program Elective- I</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM11D</td>
<td>Mechanical Behaviour of Materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM11E</td>
<td>Stress Analysis and Vibration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM11F</td>
<td>Rapid Prototyping Technologies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GM11C</td>
<td>Program Elective- II</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM11D</td>
<td>Automation in Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM11G</td>
<td>Computer Aided Process Planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM11H</td>
<td>Advanced FEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GM11J</td>
<td>Advanced CAD Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>GM11I</td>
<td>Advanced CAM Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>GM11K</td>
<td>Research Methodology &amp; Intellectual Property Rights</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(Core)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GM11L</td>
<td>Disaster Management</td>
<td>2</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Audit Course- I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits** 18
<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM12A</td>
<td>Core Course- III</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Systems, Simulation modeling &amp; Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GM12B</td>
<td>Core Course- IV</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Precision Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Program Elective- III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM12C</td>
<td>Intelligent Manufacturing Systems</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM12D</td>
<td>Special Manufacturing Process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM12E</td>
<td>Optimization Techniques &amp; Applications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Program Elective- IV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM12F</td>
<td>Advanced Mechatronics</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM12G</td>
<td>Design and Manufacturing of MEMS and Micro systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM12H</td>
<td>Design for Manufacturing &amp; Assembly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GM12I</td>
<td>Simulation of Manufacturing Systems Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>GM12J</td>
<td>Precision Engineering Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>GM12K</td>
<td>Mini Project</td>
<td>-</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>GM12L</td>
<td>Personality Development through Life Enlightenment Skills</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Audit Course-II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits**: 18
## III SEMESTER

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM13A</td>
<td>Mechanics of Composite Materials</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM13B</td>
<td>Advanced Industrial Robotics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GM13C</td>
<td>Production and Operation Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GM1OA</td>
<td>Nano Technology</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GM1OB</td>
<td>Industrial Safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GM13D</td>
<td>Dissertation Phase-I</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

## IV SEMESTER

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM14A</td>
<td>Dissertation Phase-II</td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>GM14B</td>
<td>Dissertation Phase-II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
UNIT- I:
**CAD Tools:** Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software.

**Basics of Geometric Modelling:** Requirement of geometric modelling, Geometric models, Geometric construction methods, and modelling facilities desired.

UNIT- II:
**Geometric Modelling:** Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics.

**Parametric representation of synthetic curves:** Hermite cubic curve, Bezier curve, B-Spleen curve wire, NURBS, Curvemanipulations.

UNIT- III:
**Surface Modeling:** Classification of surface entities, Surface representation methods, parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder.

**Parametric representation of synthetic surfaces:** Hermite cubic surface, Bezier surface, B- Spleen surface, Blending surface, Surface manipulations.
UNIT- IV:
**Solid Modelling:** Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators.

**Constructive solid geometry:** CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations.

UNIT- V:
**Transformations:** 2-D and 3-D transformations: translation, scaling, rotation, reflection, concatenation, homogeneous coordinates, Perspective projection, orthotropic projection, isometric projection, Hidden surface removal, shading, rendering.

**Evaluation Criteria:** Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS, CGM, and STEP. Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), least material condition (LMC), Regardless of feature size (RFS)

**TEXT BOOKS:**
1. CAD/CAM Concepts and Applications/Alavala/PHI.

**REFERENCES:**
1. CAD/CAM Principles & applications/P.N.Rao/TMH/3rdEdition
2. CAD/CAM /Groover M.P./Pearson education
3. CAD / CAM / CIM, Radhakrishnan and Subramanian/NewAge
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche /Pearson
UNIT - I
Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems. Design and implementation of post processors, Introduction to CAD/CAM software, Automatic Tool path generation

UNIT - II
Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, and quick change tooling system. Automatic head changers, automatic pallet change, Automatic pallet storage and tool re-setting system

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

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

UNIT - V

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

TEXT BOOKS:
1. CAD/CAM Concepts and Applications/Alavala/PHI.
2. CAD/CAM Principles and Applications,P.N.Rao,TMH

REFERENCES:
3. CAD / CAM / CIM, Radhakrishnan and Subramanian,NewAge
(GM11C) MECHANICAL BEHAVIOUR OF MATERIALS
(Program Elective – I)

UNIT-I:

Introduction to Deformation Behaviour: Concept of stresses and strains, engineering stresses and strains, Different types of loading and temperature encountered in applications. Tensile Test - stress-strain response for metal, ceramic and polymer, elastic region, yield point, plastic deformation, necking and fracture, bonding and Material Behaviour, theoretical estimates of yield strength in metals and ceramics

UNIT-II:

Elasticity Theory: The State of Stress and strain, stress and strain tensor, tensor transformation, principal stress and strain, elastic stress-strain relation, anisotropy, elastic behavior of metals, ceramics and polymers.

Yielding and Plastic Deformation: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, Limitation of engineering strain at large deformation, true stress and true strain, effective stress, effective strain, flow rules, strain hardening, RambergOsgood equation, stress-strain relation in plasticity, plastic deformation of metals and polymers
UNIT-III:
**Microscopic view of plastic deformation:** crystals and defects, classification of defects, thermodynamics of defects, geometry of dislocations, slip and glide, dislocation generation - Frank Read and grain boundary sources, stress and strain field around dislocations, force on dislocation - self-stress, dislocation interactions, partial dislocations, twinning, dislocation movement and strain rate.

Deformation behavior of single crystal, critical resolved shear stress (CRSS), deformation of poly-crystals - Hall-Petch and other hardening mechanisms, grain size effect - source limited plasticity, Hall-Petch breakdown, dislocations in ceramics and glasses.

UNIT-IV:
**Fracture:** fracture in ceramics, polymers and metals, different types of fractures in metals, fracture mechanics - Linear fracture mechanics -KIC, Elasto-plastic fracture mechanics - JIC, Measurement and ASTM standards.

Design based on fracture mechanics, effect of environment, effect of microstructure on KIC and JIC, application of fracture mechanics in the design of metals, ceramics and polymers

UNIT-V:
**Deformation under cyclic load** - Fatigue: S-N curves, Low and high cycle fatigue, Life cycle prediction, Fatigue in metals, ceramics and polymers

**Deformation at High temperature:** Time dependent deformation - creep, different stages of creep, creep and stress rupture, creep mechanisms and creep mechanism maps, creep under multi-axial loading, micro-structural aspects of creep and design of creep resistant alloys, high temperature deformation of ceramics and polymers.
REFERENCES:


UNIT-I:
Two dimensional elasticity theory in Cartesian coordinates.
Plane stress problem in polar coordinates thick cylinders, rotating discs - stress concentration

UNIT- II:
Torsion of non circular prismatic sections, rectangular and axi-symmetric, Circular plates.
Introduction to shell theory — contact stresses

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

UNIT- IV:
Transient vibrations of single and two degree and multi-degree of freedom systems
Applications of matrix methods, continuous systems

UNIT -V:
Free and forced vibrations of strings bars and CAD/CAM
Principle of orthogonality - classical and energy methods
REFERENCES:


2. Advanced strength of materials / DenHortog J.P./ Torrent


UNIT-I:

**Introduction:** Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms.

**Classification of RP process:** rapid prototyping process chain: Fundamental automated processes, process chain.

UNIT – II


**Solid ground curing (SGC):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

UNIT-III


UNIT – IV

**Rapid Prototyping Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats.

**Rapid Prototyping Software’s:** Features of various RP software’s like Magic’s, Mimics, Solid View, View Expert, 3 D View, Velocity 2 , Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT –V

RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules.

TEXT BOOKS:

REFERENCE BOOKS:
(GM11F) AUTOMATION IN MANUFACTURING
(Program Elective – I)

UNIT-I:
Over View of Manufacturing and Automation: 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 – II:
Material Handling and Identification Technologies: Material handling, equipment, Analysis.

Storage systems, performance and location strategies, automated storage systems, AS/RS, types, automatic identification methods, Barcode technology, RFID

UNIT – III:

Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines
UNIT – IV:
Automated Assembly Systems: Fundamentals, Analysis of Assembly systems, cellular manufacturing, part families, cooling and production flow analysis

Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – V:
Quality Control and Support Systems: 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.

REFERENCES:
2. Automation, Production Systems and CIM/ Mike P.Grower/PHI
J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
UGC AUTONOMOUS

M. Tech.: CAD/CAM
I Year – I Semester

L P C
3 - 3

(GM11G) COMPUTER AIDED PROCESS PLANNING
(Program Elective – II)

UNIT-I:
Introduction: The Place of Process Planning in the Manufacturing cycle-Process planning and production planning

Process planning and Concurrent Engineering, CAPP, Group Technology

UNIT-II:

Geometric transformation- Perspective transformation-Data Structure- Geometric modeling for process planning--GT Coding-The OPITZ system-The MICLASS System.

UNIT-III:

Process planning-Variant process planning- Generative approach- Forward and backward planning, Input format, AI.
UNIT-IV


Production Volume, Number of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT-V


REFERENCE BOOKS:

J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
UGC AUTONOMOUS

M. Tech.: CAD/CAM  
I Year –I Semester  

L P C  
3 - 3

(GM11H) ADVANCED FINITE ELEMENT METHODS  
(Core Course - III)

UNIT-I:  
Introduction to FEM, basic concepts, historical background, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin’s Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method.

Properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain-displacement relations.

UNIT-II:  
1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.

Analysis of Trusses: Plane Trusses and Space Truss elements and problems.

Analysis of BECAD/CAM: Hermite shape functions- stiffness matrix - Load vector- Problems

UNIT-III:  
2-D problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Iso-parametric elements – quadrilateral element, shape functions – Numerical Integration.
Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. **Problems:** Tetrahedran element – Jacobian matrix – Stiffness matrix.

**UNIT-VI:**
**Scalar Field Problems:** 1-D Heat conduction-Slabs – fins.
2-D heat conduction problems – Introduction to Torsional problems

**UNIT-V:**
Dynamic considerations, Dynamic equations – consistent mass matrix
Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

**TEXT BOOKS:**
1. Finite Element Methods: Basic Concepts and applications, Alavala, PHI.

**REFERENCES:**
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice–Hall
5. Finite Element Method – Krishna Murthy/TMH
6. Finite Element Analysis – Bathe/PHI
(GM11I) ADVANCED CAD LAB

I. Modelling

Modelling of Machine components using high end modeling software

II. Finite Element Analysis

(a) Structural Analysis: Determination of deflection and stresses in 2D & 3D trusses and beams. Determination deflection component principal and Von- mises stresses in plane stresses in plane stress, plane strain and Axi-symmetric component. Determination of stresses in 3D and shell structures

(b) Dynamic Analysis: Estimation of natural frequencies and mode shapes, Harmonic responses of 2D beams.

Thermal Analysis: Study state heat transfer analysis of plane and axi- symmetric components.
Features and selection of CNC turning and milling centers. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles. Practice in part programming and operating a machining center, tool planning and selection of sequences of operations, tool setting on machine. Simulation of manufacturing system using CAM software. Practice in Robot programming and its languages. Robotic simulation using software
(GM11K) RESEARCH METHODOLOGY AND IPR
(Core)

UNIT I
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
Approaches of investigation of solutions for research problem, data collections, analysis, interpretation, necessary instrumentation

UNIT II
Effective literature studies approaches, Analysis, Plagiarism, Research ethics

UNIT III
Effective technical writing, How to write report, Paper developing by research proposal, Format of research proposal
A presentation and assessment by a review committee

UNIT IV

International scenario: International cooperation on intellectual property. Procedure for grants of patents, patenting under PCT
UNIT V

**Patent Rights:** Scope of Patent Rights. Licensing and transfer of technology.

Patent information and data bases, Geographical indications

UNIT VI

**New Developments in IPR:** Administration of patent system. IPR of Biological systems, Computer software etc.

Traditional knowledge case studies, IPR and IITs

REFERENCES:

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for science and engineering students
2. Wayne Goddard and Stuart Melville, Research methodology and introduction
UNIT-I: Introduction
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II:
Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts

UNIT-III:
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-IV:
Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard;

UNIT-V: 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-VI: Disaster Mitigation: Meaning, Concept And Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation. Non-Structural Mitigation, Programs Of Disaster Mitigation in India

SUGGESTED READINGS:


2. Sahni, Pardeep Et.Al. (Eds.), Disaster Mitigation Experiences and Reflection, Prentice Hall Of India, NewDelhi.

UNIT - I:
System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages.


UNIT - II:


UNIT - III:

Simulation languages – comparison of simulation languages with general purpose languages

UNIT - IV:
Output data analysis – Types of Simulation w.r.t output data analysis – warm-up period- Welch algorithm

Approaches for Steady State Analysis – replication – Batch means methods – comparisons

UNIT –V:
Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities.

Simple fixed period inventory system – Newboy paper problem.

TEXT BOOKS:
(GM12B) PRECISION ENGINEERING
(Core Course IV)

UNIT - I:

Geometric Dimensioning and Tolerancing: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums – Datum Feature of Representation – Form Controls, Orientation Controls – Logical Approach to Tolerancing.

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

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

UNIT – IV:
Surface finish, Review of relationship between attainable tolerance grades and different machining process.

Cumulative effect of tolerances sure fit law, normal law and truncated normal law

UNIT - V:

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

TEXT BOOKS:
REFERENCE BOOKS:


(GM12C) INTELLIGENT MANUFACTURING SYSTEMS
(Program Elective III)

UNIT - I:
Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM

UNIT II:
Components of Knowledge Based Systems - Basic Components of Knowledge Based Systems, Knowledge Representation.
Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT III:
Machine Learning - Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron.
Types of Neural Networks, Applications in Manufacturing.
UNIT IV:

Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT V:

Knowledge Based Group Technology - Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm.

**REFERENCES:**
1. Intelligent Manufacturing Systems/ Andrew Kusiak /Prentice Hall.
2. Artificial Neural Networks/Yagna Narayana/PHI/2006
4. Neural networks: A comprehensive foundation/ Simon Hhaykin/PHI.
5. Artificial neural networks/B. Vegnanarayana/PHI
6. Neural networks in Computer intelligence/ Li Min Fu/TMH/2003
UNIT - I:
Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating.
Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding

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

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

E-Manufacturing: Nano manufacturing techniques and micromachining.
High Speed Machining and hot machining

UNIT - V

Rapid tooling, Techniques of rapid manufacturing.

REFERENCES:
4. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu/TMGH
5. Advanced Machining Processes / V.K.Jain /Allied Publications.
J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
UGC AUTONOMOUS

M. Tech.: CAD/CAM L P C
I Year –II Semester 3 - 3

(GM12E) OPTIMIZATION TECHNIQUES AND APPLICATIONS
(Program Elective III)

UNIT - I:
Single Variable Non-Linear Unconstrained Optimization:
Elimination methods: Uni- Model function-its importance, Fibonacci method & Golden section method.

Interpolation methods: Quadratic & Cubic interpolation methods.

UNIT - II:

Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

UNIT - III:
Linear Programming: Formulation, Simplex method & Artificial variable optimization techniques: Big M & Two phase methods.

UNIT- IV:

**Integer Programming:** Introduction – formulation – Geometry cutting plane algorithm – Zero or one algorithm, branch and bound method

**Stochastic Programming:** Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chanceconstrained algorithm.

UNIT- V:

**Geometric Programming:** Polynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤type only)

**Non Traditional Optimization Algorithms:** Genetics Algorithm- Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO) (very brief)

**TEXT BOOKS:**

2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

**REFERENCE BOOKS:**

1. Operations Research by S.D. Sharma
2. Operation Research by H.A.Taha, TMH
3. Optimization in operations research by R.L.Rardin
UNIT - I:

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

UNIT - II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering.

Introduction to MEMS & typical applications

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic.

Electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.
UNIT-IV
Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers.

Programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V
System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response.

Design of mechatronics systems & future trends.

REFERENCES:
6. Mechatronics/M.D. Singh/J.G. Joshi/PHI.
DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS
(GM12G) (Program Elective IV)

UNIT - I:

Overview and Working Principles of MEMS and Microsystems:
MEMS & Micro systems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization.

Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

UNIT II:

Engineering Science for Microsystems Design and Fabrication:
Atomic structure of Matter, Ions and Ionization

Molecular Theory of Matter and Intermolecular Force, Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

UNIT III:

Engineering Mechanics for Microsystems Design: Static Bending of thin Plates, Mechanical Vibration

Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis
UNIT IV:

UNIT V:
Materials for MEMS & Microsystems and Their Fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezo-resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography. Ion implantation, Diffusion and oxidation, chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process

REFERENCES:
(GM12H) DESIGN FOR MANUFACTURING AND ASSEMBLY
(Program Elective- IV)

UNIT - I:

Introduction: Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of designing for economical production - creativity in design.


UNIT- II

Machining Process: Overview of various machining processes - general design rules for machining - Dimensional tolerance and surface roughness - Design for machining - Ease - Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts

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

UNIT- III

Metal Joining: Appraisal of various welding processes, Factors in design of weldments - general design guidelines - pre and post treatment of
welds - effects of thermal stresses in weld joints - design of brazed joints. Forging - Design factors for forging - Closed dies forging design - parting lines of die drop forging die design - general design recommendations.


UNIT-IV

**Assemble Advantages:** Development of the assemble process, choice of assemble method; assemble advantages social effects of automation.

**Automatic Assembly Transfer Systems:** Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-V

**Design of Manual Assembly:** Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, and classification system for manual handling.

Classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.
REFERENCES:


(GM12I) SIMULATION OF MANUFACTURING SYSTEMS LAB

The students will be given training on the use and application on manufacturing simulation software:

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

M. Tech.: CAD/CAM
I Year –II Semester

(L) L P C

(GM12J) PRECISION ENGINEERING LAB

1. Hydraulic circuit
2. Pneumatic circuit
3. Closed loop control systems
4. Study of the chip formation in turning process
5. Study of operation of tool and cutter grinder
6. Study of operation of Centre-less grinder
7. Determination of cutting forces in turning
8. Inspection of parts using Toolmaker’s microscope,
9. Measurement of surface roughness using Talysurf
10. Study of micro-controllers, programming on various CNC machine tools
M. Tech.: CAD/CAM
I Year –II Semester

(GM12K) MINI PROJECT

Course Outcomes: At the end of the course, the student will be able to:

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.

Syllabus Contents:
Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals’ contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(GM12L) (Audit Course-II)

UNIT-I: Neetisatakam - Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride&heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (don’ts)
- Verses- 71,73,75,78 (do’s)

UNIT-II: Approach to day to day work and duties.

- ShrimadBhagwadGeeta : Chapter 2-Verses 41,47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17,23,35,
- Chapter 18-Verses 45,46,48

UNIT-III: Statements of basic knowledge.

- ShrimadBhagwadGeeta: Chapter2-Verses 56,62,68
- Chapter 12 -Verses 13, 14, 15,16,17,18
- Personality of Role model. ShrimadBhagwadGeeta:
- Chapter2-Verses 17, Chapter3-Verses 36,37,42,
- Chapter 4-Verses 18,38,39
- Chapter18 –Verses 37,38,63
SUGGESTED READING
1. Srimad Bhagavad Gita by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.
(GM13A) MECHANICS OF COMPOSITE MATERIALS
(Program Elective- V)

UNIT-I
Introduction: Fibres, Matrix materials, interfaces, polymer matrix composites.
Metal matrix composites, ceramic matrix composites carbon fibre composites.

UNIT-II
Micromechanics of Composites: Mechanical properties-Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses.
Thermal properties- Hygro thermal stresses, mechanics of load transfer from matrix to fibre.

UNIT-III
Macro mechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter- laminar stresses and edge effects.
Simplified composite beam solutions, bending of laminated beams
UNIT-IV
Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites,

UNIT-V
Analysis of plates and stress: Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite materials.
Analysis of composite cylindrical shells under axially symmetric loads

REFERENCES:
(GM13B) ADVANCED INDUSTRIAL ROBOTICS
(Program Elective- V)

UNIT-I

Control System and Components: basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT - II
Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation.
Manipulator path control, robot dynamics, configuration of robot controller

UNIT - III
End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.
SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.
Machine Vision: Functions, Sensing and Digitizing-imaging, Devices,
Lighting techniques, Analog to digital single conversion, image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT - IV

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

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

UNIT - V

Robot Cell DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detection, Work wheel controller.

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

REFERENCES:

1. Industrial Robotics / Groover M P/PearsonEdu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson,3rdedition.
5. Robot Analysis and Intelligence / Asada and Slotine /Wiley Inter-Science.
7. Robotics and Control / Mittal R K &Nagrath I J/TMH
(GM13C) PRODUCTION AND OPERATIONS MANAGEMENT  
(Program Elective - V)

UNIT-I  
Operation Management: Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management.  

UNIT – II  


UNIT - III  
Aggregate Planning: definition – Different Strategies – Various models of Aggregate Planning – Transportation and graphical models. Advance

Manufacturing Resources Planning (MRP –II), Pull systems – vs Push system – Just in time (JIT) philosophy Kanban System – Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

UNIT - IV
Scheduling: Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts

Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance.

UNIT – V
Project Management: Programming Evaluation Review Techniques (PERT) – three times estimation – critical path

Probability of completion of project – critical path method – crashing of simple nature

REFERENCES:

6. Production and Operation Management/PannerSelvam/PHI.


Consolidation of Nano-powders: Shock wave consolidation, Hot iso-static pressing and Cold iso-static pressing Spark plasma sintering.


Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nano-indentation

UNIT – V: Applications of Nano-materials: Nano-electronics, Micro- and Nano- electro mechanical systems (MEMS/NEMS), Nano-sensors, Nano-catalysts,


TEXTBOOKS:


REFERENCES BOOKS:

3. Transport in Nano structures- David Ferry, Cambridge Universitypress2000
UNIT-I:

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure.

Describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods

UNIT-II:

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department.

Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III:

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

Unit-IV:
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools.


Unit-V:
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

REFERENCE:

J. B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
UGC AUTONOMOUS

M. Tech.: CAD/CAM                      L    P    C
II Year – I &II Semester            -    -  10+16

DISSERTATION PHASE – I AND PHASE – II

(GM13D AND GM14A)

Teaching Scheme Lab work: 20 and 32 hrs/week for phase I and II respectively

Objectives:

At the end of this course, students will be able to

• Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.

• Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

• Ability to present the findings of their technical solution in a written report.

• Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:
• Relevance to social needs of society
• Relevance to value addition to existing facilities in the institute
• Relevance to industry need
• Problems of national importance
• Research and development in various domains

**The student should complete the following:**

Literature survey Problem Definition

• Motivation for study and Objectives
• Preliminary design / feasibility / modular approaches
• Implementation and Verification
• Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

• Experimental verification / Proof of concept.
• Design, fabrication, testing of Communication System.
• The viva-voce examination will be based on the above report and work.

**Guidelines for Dissertation Phase – I and II**

• As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

• The dissertation may be carried out preferably in-house i.e. department’s laboratories and centers OR in industry allotted through department’s T & P coordinator.

• After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored
projects, the relevant application notes, while papers, catalogues should be referred&reported.

• Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

• Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.

• Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.

• During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences ORIP/Patents.

• Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.

• Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.