SCHEME OF EXAMINATION

and

SYLLABI

for

Master of Technology
Tool Engineering

Offered by

University School of Engineering and Technology

1st SEMESTER TO 4th SEMESTER

Guru Gobind Singh Indraprastha University
Dwarka, Delhi – 110078 [INDIA]

www.ipu.ac.in
# COMPUTER AIDED DESIGN AND MANUFACTURING

**Paper Code:** ETTE-601  
**Paper:** Computer Aided Design and Manufacturing  
**L** 3  **T/P** 0  **C** 3

**INSTRUCTIONS TO PAPER SETTERS:**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

### Objective
To understand the CAD and use the same in manufacturing and introducing latest technology in CAM.

### UNIT-I
**Fundamental of CAD:** Design process, application of computers for design, benefits of the computer aided design, Computer graphics software and data base: The software configuration of a graphics system, constructing the geometry, database structure and content, wire frame and solid modeling. CAD/CAM integration.

**[T1,T2][No. of Hrs. 09]**

### UNIT-II
**Transformations:** 3D transformations, homogenous coordinates, projections: orthographic projection, perspective projection, Axonometric projection, Curves: Space curves- cubic splines, normalized cubic spline, Bezier curve, B- spline introduction, continuity, Surface: surface of revolution, sweep surface, ruled and developable surface.

**[T1,T2][No. of Hrs. 13]**

### UNIT-III
**Conventional Numerical Control:** NC coordinate systems, NC motion control system, Application of Numerical control, NC part programming, manual part programming, computer assisted part programming. Computer controls in NC: NC controller technology, computer numerical control, Direct Numerical control, combined DNC /CNC systems, Adaptive control machining systems, trends and new developments in NC.

**[T1,T2][No. of Hrs. 09]**

### UNIT-IV
**Robot Technology:** Introduction, robot physical configuration, basic robot motions, robot applications, Group technology- introduction, part families, and group technologies machine cells. Computer integrated Manufacturing systems- machine tool and related equipment, material handling system, computer control system, Implementing a CAD/CAM.

**[T1,T2][No. of Hrs. 10]**

### Text Books:

### Reference Books:

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Scheme and Syllabi for M.Tech (Tool Engg.) (1st, 2nd, 3rd & 4th Semesters) **w.e.f batch 2014-15** approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
DESIGN OF JIGS, FIXTURE & GAUGES

Paper Code: ETTE 603
Paper: Design of Jigs, Fixture & Gauges

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: To understand the theoretical and practical knowledge of design and manufacturing the Jig and fixture for machining, welding, assembly and checking the sheet metal, plastic etc component. Its gigantic application in manufacturing industry.

UNIT-I
Introduction: Definition of Jigs and Fixtures, Difference between jigs and fixtures, Advantages, Steps for design. LOCATION Degree of freedom, 3-2-1 principles, Choice of location, redundant location, Diamond pin calculation, Locating methods and chip control. Locating Devices: Surface location, Rest blocks, pins, V-blocks, N Equalizers, Profile locators. Consideration of Safety factor while designing of Jig Fixture and Gauge, materials used in jigs and fixture, locating principle, locating methods and devices, standard parts

UNIT II

UNIT III
Design of Jigs and Fixture Bodies other Elements Types of Jigs and Fixtures: Plate jigs, Box jigs, Indexing jigs, Milling fixtures, and Indexing-milling fixtures, turning fixtures, Grindng fixtures, Universal jigs and fixtures, welding fixtures, Broaching fixtures, and Assembly Fixtures. Boring fixtures.

UNIT IV

Text Books:

Reference Books:
TOOL MATERIAL & HEAT TREATMENT

Paper Code: ETTE-605                      L  T/P  C
Paper: Tool Material & Heat Treatment        4   0  4

INSTRUCTIONS TO PAPER SETTERS:  

MAXIMUM MARKS: 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the advanced knowledge of Heat treatment and engineering material used in tooling Industries.

UNIT-I
Introduction: Classification of materials, fundamentals of structures of solids, Imperfections in solids, such as point defects, line defects, volume defects etc, Deformation, Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and gain growth. Diffusion: Diffusion mechanisms, steady state and non steady state diffusion in polymer materials.

UNIT-II

UNIT-III

UNIT-IV

Text Books:

Reference Books:
INTRODUCTION TO FINITE ELEMENT METHODS

Paper Code: ETTE 607
Paper: Introduction to Finite Element Methods

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Objective: To introduce the knowledge of Finite element method for using it in engineering problems and to give the base for its use in industries.

UNIT-I
Introduction to FEM, boundary conditions, stress strain relations, Potential energy and rayleigh ritz method, galerkin’s method, von mises stress. Finite element modeling, coordinates and shape functions, element stiffness matrix, assembly of global stiffness matrix and load vector, The finite element equation, treatment of boundary conditions, quadratic shape functions, temperature effects, stress related problems.

UNIT-II
Trusses: Plane truss, three dimensional truss, constant strain triangle, Problem modeling and boundary condition, axis symmetric formulation, finite element modeling triangular element, problem modeling and boundary condition.

UNIT-III
Four node quadrilateral element, Numerical integration, higher order elements, beams and frames: finite element formulation, load vector, boundary consideration, shear stress and bending moment, beams on elastic supports, plane frames.

UNIT-IV
Steady state heat transfer: One dimensional heat conduction, one dimensional heat transfer in thin fins, two dimensional steady state heat conduction, two dimensional fins, torsion, Computer procedures for Finite element analysis, fluid flow, related problems.

Text Books:

Reference Books:
PRODUCT DESIGN AND DEVELOPMENT

Paper Code: ETTE -609
Paper: Product Design and Development

L T/P C

4 0 4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Product design and Development and its application in different type of Industries.

UNIT-I
Introduction to Product Design: Characteristics of product design and development, Cost estimation, Challenges of product design and development.

[No. of Hrs. 08]

UNIT-II
Development Processes and Organisations: A generic development process, concept development; the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization. Product Planning: The product planning process, identify opportunities, Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

[No. of Hrs. 12]

UNIT-III
Identifying Customer Needs: Raw data collection and interpretation, Organization of the needs, Establishment of the relative importance: effect on the results and the process.
Product Specifications: Introduction, establishment, setting target and final specifications.

[No. of Hrs. 12]

UNIT-IV
Concept Selection: Overview of methodology, concept screening, concept scoring, caveats.
Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.
Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, Design for Manufacturing

[No. of Hrs. 12]

Text Books:

Reference Books:
MACHINING PROCESS & ANALYSIS

INSTRUCTIONS TO PAPER SETTERS:

- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
- Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with good knowledge of metal cutting mechanism and how it can be affected by the various parameters.

UNIT-I
Introduction to Machining: Need of manufacturing and its definition, classification of Engineering manufacturing Processes, various process parameters for machining. Geometry of single point tools such as Machine Reference System or ASA system, Orthogonal Rake System and their conversion to each other.

UNIT-II
Mechanics of Machining: Mechanism of Chip formations in ductile & brittle materials, Chip reduction coefficient or cutting ratio, Shear Angle, Cutting strain, Built-up-Edge (BUE) formation, Characteristics of BUE, Classification of machining chips, Orthogonal cutting and oblique cutting, cause of chip flow deviations, Need and purpose of chip breakers, various types of chip breakers, cutting forces components and their significance, cutting forces in drilling. Merchant’s Circle Diagram and its use, Dynamometer: it principal of measurement, Design requirements for Tool – force Dynamometers

UNIT-III

UNIT-IV

Text Books:
[T1] A.B. Chattopadhyay “Machining and Machine Tools” Wiley India

Reference Books:
COMPUTER AIDED DESIGN AND MANUFACTURING LAB

Paper Code: ETTE-651  
Paper: Computer Aided Design and Manufacturing Lab  
L T/P C  
0 2 1

List of Experiments:

1. To study sketcher mode and make the related exercise.
2. To study extrude feature and its exercises.
3. To study revolve feature and its exercises.
4. To study sweep feature and its exercises.
5. To study blend feature and its exercises.
6. To study hole feature and its exercises.
7. To study pattern feature and its exercises.
8. To study the sectioning feature and its exercises.
9. To study the advanced feature in part mode and its exercises.
10. To study assembly mode and its exercises.
11. To study the drawing mode and its exercises.
12. To study and practise manufacturing module and its exercise.
13. To study and practice manufacturing module using fixed/c cycle.
14. To study and practice manufacturing module using macro programming.

Software Used: Creo, CATIA, NX-7 should be used for performing the experiments.

Atleast 8-10 experiments are mandatory to conduct in semester.
DESIGN OF JIGS, FIXTURE & GAUGES LAB

Paper Code: ETTE 653
Paper: Design of Jigs, Fixture & Gauges Lab

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List of Experiments:

1. Design of drill jigs & fixture for milling operation.
2. Design of drill jigs & fixture for turning operation.
3. Design of drill jigs & fixture for Broaching operation.
5. Design of Plug and Ring Gauges.
6. Design of positional fixture to hold the component.
7. Design of grinding fixture given component.
8. Design of various types of clamps.
10. Design of taper gauges of given components.
11. Design of jigs & Fixture for turning operation for given component.
12. Design of jig plate.

Atleast 8-10 experiments are mandatory to conduct in semester.
INTRODUCTION TO FINITE ELEMENT METHODS LAB

Paper Code: ETTE-655
Paper: Introduction to Finite Element Methods Lab

L T/P C
0 2 1

EXPERIMENTS TO BE DONE IN ANY FEM BASED ANALYSIS SOFTWARE

1. Stress Analysis of cantilever beam
2. 2-D truss stress analysis
3. Stress Analysis of wall bracket
5. Plane frame analysis.
7. Stress due to gravity analysis.
8. Bending of curved beam analysis.
9. Stress analysis in bar of variable cross-section.
10. Modal Analysis.

Atleast 8-10 experiments are mandatory to conduct in semester.
### METROLOGY

**Paper Code:** ETTE-602  
**Paper:** Metrology  

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**INSTRUCTIONS TO PAPER SETTERS:**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

**Maximum Marks:** 60

*Objective:* The objective of the paper is to facilitate the student with the good knowledge of measurement with help of various advanced measuring instruments.

### UNIT - I


**[T1,T2]** [No. of Hrs. 10]

### UNIT-II

**Types of Inspection:** Inspection by Gauging: limit gauging, plug gauges, Ring gauges, position gauges. Inspection by Measurement: Direct measurement such as Vernier Caliper, Vernier Height gauge, Vernier Depth gauge Outside Micrometer, Inside Micrometer, Depth Micrometer, Slip gauges (gauge blocks), length bars, Bevel protractor etc. Indirect Measurement such as Mechanical, optical, & pneumatic comparators, Angular Measurements: Sine bar, angle gauges, precision levels, autocollimator, interferometers, NPL Flatness Interferometer etc.

**[T1,T2]** [No. of Hrs. 12]

### UNIT-III

**Measurement of Screw threads & Gears:** Measurement of elements of screw threads such as major diameter, minor diameter, pitch, flank angle and effective diameter, Threads gauges, Gear terminology and standard proportions, Spur gear measurement, Tooth thickness measurement, Parkinson Gear Tester.

**[T1,T2]** [No. of Hrs. 10]

### UNIT-IV

**Surface texture, Geometric Features & CMM:** Introduction to surface finish, Nomenclature of surface finish, various roughness parameters and their significance, Measurement of surface roughness, Tomlinson Surface meter, Taylor – Hobson Talysurf, measurement of geometric feature inspection such as straightness, Flatness, Squareness Roundness, etc. Introduction to Coordinate Measuring Machine (CMM), Types of CMM, Probes, and accessories, In-Process gauging, Post Process Inspection, etc.

**[T1,T2]** [No. of Hrs. 12]

**Text Books:**


**Reference Books:**


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INTRODUCTION TO METAL FORMING & PRESS TOOL DESIGN

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<th>Paper Code</th>
<th>ETTE-604</th>
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<td>Paper</td>
<td>Introduction to Metal forming &amp; Press Tool Design</td>
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**INSTRUCTIONS TO PAPER SETTERS:**

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

**Objective:** To understand the theoretical and practical knowledge of metal forming process and its used in sheet metal industries.

**UNIT I**

**INTRODUCTION TO METAL FORMING:**

Classification of various Forming Process, Cold, Hot, and warm Forming, Component of Stresses, Principal Stresses, Stress Invariants, Mean stress, Stress Deviator, Mohr’s Stress circles, Shear strain theory, strain measure, Elastic Stress-Strain Laws, Von-Mises Stress-strain rate law, Tresca yield criterion; Von-Mises yield criterion.

Forging: Introduction, forging machines, open-die forging, closed-die forging, Impression Die forging, Forging defects, calculation of forging loads in closed-die forging.


**[T1,T2][No. of Hrs. 12]**

**UNIT II**

**Principles of Blanking and Piercing Dies:** Basic Blanking or piercing operation, Shearing Theory, calculation of cutting force and stripping force, importance of cutting force, calculation of press tonnage, calculation of cutting clearance, importance of cutting clearance, Method of reducing the cutting force, Calculation of die size and punch size for blanking and piercing operation. Function of screw hole and dowel holes, Effects of Die and Punch life.

**[T1,T2][No. of Hrs. 10]**

**UNIT III**

**Introduction to various parts of Blanking and Piercing Dies:** Function, types and construction of Punches, Punch Plate, Die Plate, stripper plate, Top Plate, Shank, Guide pillar, Guide Bushes, gages, Stock guides, Die stops, Nest Gages and Pushers, Stock material utilization and strip layouts, Materials selection and used for above referred parts. Types of Die Sets, Spring selection process. Design of blanking, Piercing Dies, Types and function of Pilots.

**[T1,T2][No. of Hrs. 10]**

**UNIT IV**

**Introduction and Design of Bending Dies:** Basic of Bending, bending stress, bend allowance curve, estimating Flat Blank lengths, Introduction to Bending Dies to produce V, L and U shaped Bend components, Grain direction, Spring back effect, calculation of bending force and pad force, Design of Bending Dies.

**[T1,T2][No. of Hrs. 10]**

**Text Books:**


**Reference Books:**


[R4] Surender Kumar, Technology of Metal Forming Process, PHI Learning Private Limited@2008


[R7] Design Data Hand Book, Delhi Institute of Tool Engineering, Delhi
THEORY OF DIE CASTING AND DIE DESIGN

Paper Code: ETTE 606        L  T/P  C
Paper:  Theory of Die Casting and Die Design  4  0  4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Die Casting and Die Design and it’s application in different type of Industries.

UNIT I
Introduction: Die casting process, Advantages, Applications, Classification of Castings, Sand casting, Metal mould Castings (Aluminium, Zinc), Plastic moulds casting, Investment casting, Gravity die casting, Pressure die casting.
Die Casting Alloys: Different alloys, properties and application.

UNIT II
Die Casting Machines: History of die casting machines, Hot chamber machine, cold chamber machine, Horizontal machine, Vertical machine.
Die locking methods: Hydraulic with toggles, straight hydraulic, Mechanical. Injection systems, knock out pins and plates, Feed System Gates, Runners, Taper tangent runner system, Spreader, PQ2 Diagram and calculations etc.

UNIT III
Types of Dies: Single cavity dies, Multi cavity dies, combination dies, unit dies, trimming and finishing of components, Metal melting and handling.

UNIT IV
Inspection: Inspection, Die casting, defects and remedies.
Cost Estimation: Estimating the cost of die castings.
Safety: Safety-Melting and Alloying Department, Casting Department, Machining and Trimming and Maintenance Department.
Recent developments in the field of Die Casting.

Text Books:

Reference books:
INTRODUCTION TO PLASTIC & PLASTIC PROCESSING

Paper Code: ETTE - 608                   L    T/P    C
Paper: Introduction to Plastic & Plastic Processing 4    0    4

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the processing techniques in detail and also to make them understandable with the behavior of plastics while processing with different processing techniques.

UNIT-I
Introduction : Concept of Monomer, Polymer, Degree of Polymerization, Classification of Polymer, Molecular Weight Distribution, Types of Polymerization: chain polymerization and step polymerization, Polymerization techniques: Bulk, Solution, Suspension and Emulsion techniques, Concept of Copolymer, Glass Transition and Melting Transition Temperature, General review of Properties and Application of various plastics:- PE, PP, PS, PVC, PMMA, ABS, NYLON, Polyacetal, Polycarbonate, PTFE, PF, UF & MF. Biodegradable and conducting plastics.

UNIT-II
Additives for plastics: fillers, antioxidants, thermal stabilizers, lubricants, plasticizers, fire retardants, blowing agents, Impact Modifier, mixing and compounding equipment.

Introduction to plastics processing, Injection Moulding: Principles, moulding cycle, Types of machinery used, specification machines specifications - projected area, plasticizing capacity, shot weight, Day light, mould clamping system – toggle and hydraulic system. Faults and remedies, Injection moulding of thermosets.

UNIT-III
Compression and Transfer Moulding: Techniques, machinery used, Compression moulding cycle, common moulding faults and remedies. Transfer moulding, Technique, types of transfer moulding, its advantage over compression moulding, equipment used, faults and Blow Moulding remedies.

Extrusion: General description of extrusion processes; type of extruders, screw and their output in terms of drag, leakage and pressure flow, L/D ratio, compression ratio, back pressure, influence of screw dimensions and output, extrusion screw design features, extruder faults - causes and remedies. Film extrusion, sheet extrusion, Pipe extrusion, coating extrusion.

UNIT-IV

Rotational moulding: Description and features of rotational moulding process.

Thermo Forming: Basic principles. Description of various thermoforming processes.

Miscellaneous Process: Casting and Calendaring.

Text Books:

Reference books:
# CNC TECHNOLOGY & PROGRAMMING

**Paper Code:** ETTE-610

<table>
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<th>Paper: CNC Technology &amp; Programming</th>
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**INSTRUCTION TO PAPER SETTER:**

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**Objective:** The objective of the paper is to facilitate the student with the good knowledge of CNC Programming & Technology and latest development in the field.

**UNIT I**

Introduction to NC/CNC/DNC, overview of CNC machines- need, benefits & limitations, classification of CNC machines, Constructional features of CNC machines, Design considerations of CNC machine tools, elements of CNC machine & systems, precision measuring & positioning of CNC, Function of MCU, Machining centre, Turning centre, CNC EDM, Ball screw, Bearings, Centralised lubrication systems, its role in FMS and CIMS.

**UNIT II**

Manual part programming - preparatory, miscellaneous functions- Fanuc, Sinumeric, Hass controls. Linear interpolation, circular interpolation, canned cycles, cycles of threading & grooving operations, tool compensation, sub-program, main program, part programming structure, work co-ordinate system, absolute & incremental commands, feed, program zero point, co-ordinate system, process planning & flow chart for part programming, scaling, rotating, mirroring, copy & special cycles for CNC lathe and milling, radius & length compensation, advance programming features.

**UNIT III**

Tooling for CNC machine: introduction, cutting tool materials, types of cutting tools for NC machines, tool selection, ISO specification of cutting tools, different clamping system in tool holders, tooling for milling, angle plates, CNC vices, work holding devices, clamps, rotary tables.

**UNIT IV**

CNC Program generation from CAD models, geometric modelling for NC machining & machining of free-form surfaces, CNC controller & motion control in CNC system. Application of CNC and recent advances in CNC machines, maintenance of CNC machine tools, CNC trainer, CNC hardware elements including drives actuators sensors, construction of modern CNC machine tool controller, NC program verification & virtual NC.

**Text Books:**


**Reference Books:**

| [R3] Binit Kumar Jha, “CNC Programming Made Easy”, UBS Publisher’s distributors limited, N Delhi |

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GENERATIVE MANUFACTURING

Paper Code: ETTE-612  
Paper: Generative Manufacturing  
L T/P C  
4 0 4

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Objective: To learn the material additive process for rapid manufacturing and utilize this knowledge in the industries.

UNIT-I

UNIT-II

UNIT-III
Laser Engineering Net Shaping (LENS) : Rapid Tooling: Indirect Rapid tooling –Silicone rubber tooling –Aluminium filled epoxy tooling, Spray metal tooling, Cast kirkite, 3Q keltool, etc. Direct Rapid Tooling Direct AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling. Software for RP: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

UNIT-IV

Text Books:

Reference Books:
METROLOGY LAB

Paper Code: ETTE-652  
Paper: Metrology Lab  
L  T/P  C  0  2  1

List of Experiments:

1. Measure the given threads elements on the profile projector.
2. Cup Drawing Test for the Sheet Metal.
4. Use of Slip Gauges in measurement of the component
5. To find the hardness of the given component
6. To inspect the given component with respect to the component drawing
7. Angle measurement by the use of sine bar.
8. To find the effective tooth thickness with the help of Gear tooth Vernier Caliper.
9. To find the flatness of the given component with the help of Sine bar and Dial indicator.
10. To find the straightness of the given component with the help of autocollimator.
11. Measurement of screw thread measurement with the help of floating carriage micrometer.
12. Inspect the given component under the Tool microscope.

Atleast 8-10 experiments are mandatory to conduct in semester.
**INTRODUCTION TO METAL FORMING & PRESS TOOL DESIGN LAB**

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<td>Paper</td>
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**LIST OF EXPERIMENT:**

1. Design of Blanking Die with fixed stripper having lower plan view, upper plan view given any blank shape.
3. Details, Balloning and BOM of the same Blanking given in Sr. No. Die.-1.
4. Design of Blanking Die with moving stripper having lower plan view, upper plan view given any blank shape.
6. Details, Balloning and BOM of the same Blanking Die given in Sr. No.-4.
7. Design of Piercing Die having lower plan view, upper plan view given any piercing shape component.
10. Design of 'V' Bending Die having lower plan view, upper plan view given any V shape bend component.
11. Sections, Details, Balloning and BOM of the same V Bending Die given in Sr. No.-10.
12. Design of 'U' Bending Die having lower plan view, upper plan view, section given any U shape bend component BOM of the parts.

Atleast 8-10 experiments are mandatory to conduct in semester.
CNC TECHNOLOGY & PROGRAMMING LAB

Paper Code: ETTE-658        L   T/P   C
Paper: CNC Technology & Programming Lab          0   2   1

List of Experiments:

2. Study of Duplostandard CNC lathe – programming codes- programs for simple components using linear interpolation, circular interpolation; study of tools & zero offsets.
3. Create a part program for component using canned cycles on Graziano or Duplostandard CNC lathe for internal drill, boring & simulate in the software.
4. Create a part program for component using cycle of thread cutting and grooving operation on Graziano or Duplostandard CNC lathe & simulate in the software.
5. Absolute programming – Incremental programming – mixed programming for component on Graziano or Duplostandard CNC lathe & simulate in the software.
6. Create a part program for step turning & simulate in the software using G90 cycle of FANUC control.
7. Create a part program for multiple turning operations & simulate in the software using stock removal cycle and finishing cycle G71, G70 of FANUC control.
8. NC program generation practice from CAD models.
11. Create a part program on MCM HMC for mirroring, Scaling, Rotation & simulate in software using sub-program & main program.
12. Create a part program on MCM HMC using Parametric programming method for engraving a profile on the top of a surface.

Software Used: Creo, CATIA, NX-7 should be used for performing the experiments.

Atleast 8-10 experiments are mandatory to conduct in semester.
INDUSTRIAL AUTOMATION & PROCESS CONTROL

Paper Code: ETTE-701

Paper: Industrial Automation & Process Control

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INSTRUCTION TO PAPER SETTER

- Question no. 1 should be compulsory & cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
- Apart from question no. 1, rest of the paper shall consist of four units as per syllabus. Every unit should have two questions. However, student may be asked to attempt only one question from each unit. Each question should be of 10 marks.

Objective: After going through this course, the student should be able to identify the Automation Control problems in any existing process control setup and also can define and assist a Designer in various stages of developing the viable solutions to industrial process control problems/relevant Greenfield projects.

UNIT I

Introduction, Definition and Basic concepts of Control Engg., Classifications of controls. Control chain breakup. Types of automation, Degree of automation, Technical, Economic and human factors in automation. Review of material handling systems using in-line transfer, rotary transfer by Geneva mechanism, electro-hydraulic or pneumatic systems as applied in Product Lifecycle & Manufacturing functions.

UNIT II

Comparative study of Technologies used in automation – Mechanical, Electrical, Hydraulic, Pneumatic, Electronic, Hybrid systems. Different classes of valves and elements used in pneumatics, hydraulic systems. ISO/DIN symbology. Logical approach for Development of small automation systems using different form of control and operative media.

UNIT III

Industrial logic control systems, PLC’s, Logic diagramming & Elements used for automation circuits, Circuit optimization techniques. Illustrative examples of the above types of systems as well as hybrid systems used for Tooling and supporting applications in industry.

UNIT IV

Recent trends in Industrial logic control systems, Programmable controllers, Designing for automation in Tool design and manufacturing, Cost-benefit analysis.

Text Books:


Reference Books:

ADVANCED PRESS TOOL DESIGN

Paper Code ETTE-703
Paper: Advanced Press Tool Design

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INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of this paper is to introduce the various dies used in Tool Engineering.

UNIT I

UNIT II

UNIT III

UNIT IV

Text Books:

Reference Books:
[R6] Design Data Hand Book, Delta Institute of Tool Engineering, Delhi
INJECTION MOULD DESIGN AND ANALYSIS

Paper Code: ETTE 705
Paper: Injection Mould Design and Analysis

INSTRUCTIONS TO PAPER SETTERS:

Objective: The objective of the paper is to facilitate the student with the basics of injection mold and Design and its application in different type of Industries.

UNIT 1
Introduction to injection mould and its construction: Methodical Mould Design – Number of Cavities, Selection of Injection Moulding Machine, clamping force calculations, Mould materials and their selection criteria, Design of various Injection mould elements, cores, cavities, and Inserts, fitting core and cavity inserts, mould plate fastening, tapered locations, attachment of mould to platen, pillars and bushes.

UNIT-2

UNIT-3
Parting Surfaces: Straight, stepped, curved parting Surface.

UNIT-4
Moulds with internal under cuts: Form pins, split cores, side cores, stripping internal undercut.

Text Books:

Reference Books:

Scheme and Syllabi for M.Tech (Tool Engg.) (1st, 2nd, 3rd & 4th Semesters) w.e.f batch 2014-15 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
**INDUSTRIAL MANAGEMENT**

Paper Code: ETTE-707
Paper: Industrial Management

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**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

**Objective:** The objective of this paper is to define the functions of management in achieving quality of design and maintenance of quality management standards.

**UNIT – I**

**UNIT-II**
Plant Location: - Introduction, theories of industrial location, factors affecting for location, facility location Models, Plant layout: objective & principal of plant layout, Types of layouts, factors affecting layout, Group technology layout, Method study, principal and procedure, flow process charts, micro motion study, Work measurement, principal of time study, Method-Time-Measurement, motion economy.

**UNIT – III**

**UNIT-IV**
PERT/CPM, Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

**Text Books:**
[T1] Production planning control & Industrial management by K.C Jain & L.N. Aggarwal, Khanna publishers
[T2] Industrial Engineering & management Systems by Dr S.Dalela & Dr mansoor Ali, Standard publishers distributors.

**References Books:**
PRODUCT RELIABILITY AND MAINTENANCE

Paper Code: ETTE-709
Paper: Product Reliability and Maintenance

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Product Reliability and Maintenance and its application in different type of Industries

UNIT I

UNIT II
Design of variables: Combination of Random Variable's in Design, Interference Theory and Reliability Computation, Reliability Design Examples.

UNIT III
Reliability models: Time Dependent Stress-Strength Models, Dynamic Reliability Models.
Reliability Estimation: Weibull Distribution, Sequential Life Testing, Use of signal flow graph theory for evaluating reliability.

UNIT IV

Text Books:

Reference Books:
INTRODUCTION OF COMPOSITE MATERIALS AND ITS PROCESSING

Paper Code: ETTE-711
Paper title: Introduction of Composite Materials and its Processing

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INSTRUCTIONS TO PAPER SETTERS:
MAXIMUM MARKS: 60

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2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the basics of the properties of various polymer matrixes, reinforcement used for the composites and to learn various processing techniques and applications of composite materials.

UNIT-I
Introduction of Composites, Resins for composites, Reinforcements for composites, Fibrous and particulate composites, Composite based on inorganic matrix, Additives for composites, Macro and micromechanical behaviour of laminae and laminated composites. Failure criteria of composites.

UNIT-II
Primary Processing techniques – Hand layup, Spray layup, prepreg layup, Resin Tranfer Moulding(RTM), Reaction injection moulding (RIM), Reinforced reaction injection moulding (RRIM), Structural reaction injection moulding (SRIM), Filament winding, Pultrusion, Compression moulding, Moulding compounds – SMC, DMC.

UNIT-III
Secondary Processing techniques: Machining of composite-Drilling, Sawing, Edge trimming, Water jet Machining, Laser Machining, Electro-discharge Machining, Electro-Chemical Machining. Joining of Composite- adhesive Bonding, Cocuring and lamination, Solvent Bonding, Mechanical joining.

UNIT-IV
Composite Characterization-Physical and Mechanical properties, Composite application-Transportation, Marine, Aerospace, construction, Electrical, Sports and others.

Text Books:

Reference Books:
**ADVANCES IN MACHINING TECHNOLOGY**

**Paper Code:** ETTE-713  
**Paper:** Advances in Machining Technology  
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**Objective** The objective of the paper is to facilitate the student with the basics of Non-Conventional or Modern Manufacturing Methods and its application in different type of Industries.

### UNIT-I

**Mechanical Processes:** Ultrasonic Machining- Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitations of the process, advantages and disadvantages. Abrasive Jet Machining- Variables in AJM, metal removal rate in AJM. Water Jet Machining- Jet cutting equipments, process details, advantages and applications.

**UNIT-II**

Electrochemical and Chemical Metal Removal Processes: Electrochemical Machining- Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding – Material removal, surface finish, accuracy, advantages, applications.

### UNIT-III

Thermal Metal Removal Processes: Electric Discharge Machining (EDM) or spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Laser beam machining (LBM)- Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.

### UNIT-IV

Plasma Arc Machining (PAM): Plasma, non thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. Electron Beam Machining (EBM) – Generation and control of electron beam, theory of electron beam machining, process capabilities and limitations.

### Text Books:

### Reference Books:
- [R1] Non Traditional Manufacturing Processes- Benedict G.F, Marcel Dekker
- [R2] Advanced Methods of Machining- Mc Geough J.A, Chapman and Hall
ADVANCED MOULD TECHNIQUES

Paper Code: ETTE-715
Paper: Advanced Mould Techniques

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2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Objective: The objective of the paper is to facilitate the student with the basics of advanced moulding techniques its application in different type of Industries.

UNIT-I


[No. of Hrs. 12]

UNIT-II

Gas Assisted molding: Basic Principle, Control of gas Delivery, Lower Pressure Moulding, full short moulding, benefits and limitation of GAM, Equipments for GSM, Injected gas into plastic, Thick section or Rod like moulding, External Gas Moulding, Application and future of GAM.

[No. of Hrs. 10]

UNIT-III

Blow Moulding: Micro processor / CNC controlled blow moulding machine, injection stretch blow moulding of PET, precut moulding, multi layer blow moulding, Parission programming.

[No. of Hrs. 08]

UNIT-IV

PTFE Moulding: Processing techniques used for PTFE, Material consideration, sintering, Ram extrusion, Paste extrusion, Iso statistic. Moulding and skewing technique for PTFE processing, Advancement in Other Processing Technique: New techniques like Resin transfer moulding, Pultrusion, Filament winding, multi layer rotation moulding, Electro plating and printings, Centrifugal casting, Shrink film, Cling film.

[No. of Hrs. 12]

Text Books:


Reference Books:

INDUSTRIAL AUTOMATION & PROCESS CONTROL LAB

Paper Code: ETTE-751
Paper: Industrial Automation & Process Control Lab

List of Experiments:

1. Open and closed loop exercises with linear drive for A-stable Memory controls.
2. Open and closed loop exercises with linear drive for Bi stable Memory controls
3. Co-ordinated motion control using A or B stable Linear drives
4. Time dependent sequence control Ex. with single and double actuator
5. Pressure dependent sequence control Ex. with double actuators
6. Metering/Throttling in and metering/throttling out control exercises on speed regulation of actuators
7. Practicals showing Application of transducers: PE and EP type
8. Forward/ Reverse, Start/Stop control of a 3Ø Induction Motor using Programmable Logic Controller (PLC)
9. Square wave generation with duty cycle of 5 Secs ON & Off Time using timers
10. Generating RTC using timer and counter
11. Generating Square Cycle using Bi-Stable Electro-Pneumatic Valve
12. Lift Controller using PLC

Atleast 8-10 experiments are mandatory to conduct in semester.
ADVANCE PRESS TOOL DESIGN LAB

Paper Code ETTE-753
Paper: Advance Press Tool Design Lab

LIST OF EXPERIMENT:

1. Design of INVERTED DIE with knockout arrangement for any shape.
2. Sections of assembly Dies of the same Die given in Sr. No Die.-1.
3. Detailing, Balloning and BOM of the same Die given in Sr. No Die.-1.
4. Design of COMPOUND DIE with shedder-knockout and shedder -spring arrangement given any shape component.
5. Sections of assembly Dies of the same Die given in Sr. No Die.-4.
7. Design of PROGRESSIVE DIE having lower plan view, upper plan view given any shape of the parts.
8. Sections of assembly Dies of the same Die given in Sr. No Die.-7.
10. Design of PROGRESSIVE DIE given bending shape of the component having three or more stations.
12. Design of Lancing, Combination, restrike tool (any one) given shape component.

Atleast 8-10 experiments are mandatory to conduct in semester.
INJECTION MOULD DESIGN AND ANALYSIS LAB

Paper Code: ETTE -755
Paper: Injection Mould Design and Analysis Lab

L T/P C
0 4 2

Design and analysis of the following types of moulds:

1. Two plate moulds with pin ejection and edge gate.
2. Mold flow analysis Warpage analysis of two plate moulds with pin ejection and edge gate.
3. Multi-impression moulds with sleeve ejection and submarine gate
4. Mold flow analysis Flow analysis Multi-impression moulds with sleeve ejection and submarine gate
5. Multi-impression moulds with stripper plate ejection
6. Mold flow analysis Multi-impression moulds with stripper plate ejection
7. Multi-impression moulds with internal undercut
8. Mold flow analysis Multi-impression moulds with internal undercut
9. Two plate moulds with split and side core
10. Mold flow analysis two plate moulds with split design and side core
11. Two plate moulds for threaded parts (loose core and automatic rack & pinion design).
12. Three plate moulds with multi impressions

Atleast 8-10 experiments are mandatory to conduct in semester.