



**MASTER CERTIFICATE COURSE  
IN PRODUCT DESIGN**



**curriculum**

**Ministry of Micro, Small and Medium  
Enterprises, New Delhi  
(MSME-Technology Centre)**

COURSE NAME: Computer Aided Design (CAD-Auto CAD and Solid Works)

COURSE CODE:

COURSE OUTCOMES: The aim of this course student should be able to:

- Understand types of different CAD/CAM/CAE software.
- Create 2D geometric sketches by using Auto CAD/Collab CAD and Solid works a software.
- Develop 3D modeling by using advanced command.
- Clarify of Knowledge to the assembly constraint & develop different types of assembly design by using Collab CAD & Solid Work.
- Understand design generative & interactive drafting.

THEORY HOURS: PRACTICAL HOURS: 120

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	Marks	
UNIT-I		At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Understand CAD/CAM/CAE software.</li> <li>• Understand various feature in CAD software.</li> <li>• Understand various types of CAD software.</li> <li>• Understand Uses and Importance of CAD software in Industries.</li> <li>• Understand selection criteria of CAD software.</li> </ul>	Capability of CAD Software and Introduction to AutoCAD, Collab CAD, Solid Work. Description of the feature that have been added or changed since new Release CAD. Criteria for selection of CAD workstations, Shingle Design Process, Design criteria, Geometric modeling, entities, 2D & 3D Primitives. Different Types of cad software. Also comparison of various CAD Software. CAD software features. Concept of hardware & software.	20	8	
UNIT-II		At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Understand drawing curve object.</li> <li>• Create various types of sketch geometry.</li> <li>• Understand editing property tools.</li> <li>• Understand controlling drawing display.</li> <li>• Understand geometric dimension &amp; tolerance method</li> </ul>	Drawing curve objects (Circle, Arc, Ellipse, elliptical arcs). Creating solid filled areas- Regions, Hatch, Dot-nut, DD type. Drawing line object like line, polyline, multiline etc. Drawing curve objects like Circle, Arc, Ellipse, elliptical arcs etc. Editing objects using the object property tool bar and various method & Controlling Drawing Display. (Carry, Lengthen, Stretching, Offset, Align, Trim, Extend, Array etc. Detailed discussion on Dimensions, Geometrical Dimension, Tolerance method in AUTOCAD.	25	12	

UNIT-III		<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Working with block &amp; defining block attributes.</li> <li>• Understand Concept of Isometric Drawing, Layout &amp; Plotting.</li> <li>• Execute of solid modeling / 3d modelling.</li> <li>• Create surface modeling.</li> </ul>	<p>Working with block &amp; defining block attributes. Concept of Isometric Drawing, Layout &amp; Plotting. Creating of solid modeling / 3d modelling. Like creating, Editing, and modification technique. Creating of surface modeling like creating, Editing, and modification technique.</p>	25	14	
UNIT-IV		<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand Capability of Solid work Software.</li> <li>• Understand Basic Part Modeling, Basic Modeling, Terminology, Choosing the Best Profile, Choosing the Sketch Plane, Details of the Part feature.</li> <li>• Understand concept of assembly constraint.</li> <li>• Clarify Different type of assembly.</li> </ul>	<p>Introduction &amp; Capabilities of Solid Work. SolidWorks Basics and the User Interface What is the SolidWorks Software Design Intent File References Opening Files The SolidWorks User Interface. Basic Part Modeling, Basic Modeling, Terminology, Choosing the Best Profile, Choosing the Sketch Plane, Details of the Part Boss Feature, Patterning, revolving, shelling, ribs &amp; editing features. Assembly- Bottom-Up Assembly, Creating a New Assembly.</p>	25	12	
UNIT-V		<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand Bill of Materials.</li> <li>• Create Assembly Drawings.</li> <li>• Create &amp; draw various drafting views.</li> <li>• Understand dimensions, annotations &amp; various Engineering symbols.</li> </ul>	<p>Bill of Materials, Assembly Drawings, Drafting generate standard three views, model view, and predefined view, standard section views, crafting drawings, creating dimensions, annotations, notes and surface finish symbols, add geometric tolerance to the drawing views, add center marks and center lines to the drawing views, add center marks and center lines to the drawing views</p>	25	14	

COURSE NAME: Advanced-CAD (CREO PARAMETRIC)

COURSE CODE:

COURSE OUTCOMES: The aim of this course student should be able to:

- Understand advance Computer aided design software (CREO PARAMETRIC) as compare to other CAD software.
- Create 2D geometric sketches by using CREO PARAMETRIC software.
- Develop 3D solid & surface modeling by using advanced command.
- Understand assembly constraint & develop different types of assembly design.
- Understand design generative & interactive drafting.
- Apply knowledge in create complicated modeling & creative/innovative solution.

THEORY HOURS:

PRACTICAL HOURS: 80

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	Marks	
UNIT-I		At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Understand advance computer aided design.</li> <li>• Understand Different types CAD software.</li> <li>• Understand advanced features added &amp; changed since new release software.</li> <li>• Understand difference between various software as compare to CREO PARAMETRIC &amp; CATIA.</li> <li>• Execute the concept of hardware &amp; software.</li> </ul>	Capability of CAD Software and Introduction to CREO PARAMETRIC & CATIA. Description of the feature that have been added or changed since new Release software. Criteria for selection of CAD workstations, Shingle Design Process, Design criteria, Geometric modeling, entities, 2D & 3D Primitives. Different Types of cad software. Also comparison of various CAD Software. CAD software features. Concept of hardware & software.	2	4	
UNIT-II		At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Have knowledge in sketching interface.</li> <li>• Understand various sketch profile tool.</li> </ul>	Sketching in CREO PARAMETRIC, Creating and constraining various sketch profile, Operations on sketch Geometry viz. corner, quick trim, break, chamfer. Project 3D Elements, Intersect 3D Elements, Isolate sketch profile. Various sketch based projects.	24	16	

		<ul style="list-style-type: none"> <li>• Have Knowledge various modification tools.</li> <li>• Create complicated geometry sketch</li> <li>• Understand &amp; Use Project 3D Elements, Intersect 3D Elements, Isolate sketch profile</li> </ul>			
UNIT-III		<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand 3D Modeling concept.</li> <li>• Use various workbench based feature.</li> <li>• Illustrate advanced Transformation features.</li> <li>• Use and create Surface Based Features.</li> <li>• Execute various surface creation methods.</li> <li>• Perform advanced solid &amp; surface modeling</li> </ul>	<p>Various workbench based features viz. pad, pocket, shaft, Groove, Hole etc. Transformation Features Translate, Rotate, Mirror, R/C pattern, Scale etc. Surface Based Features split, close surface, sew surface. Various advance tasks power copy, catalogs, design table etc. Tweak features. Various surface creation methods method extrude, revolve, offset, swept, loft. Operation on shape geometry join, healing, trim, extract geometry projects. Advanced commands e.g. bend solid, toroid bend etc.</p>	30	24
UNIT-IV		<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand concept of assembly constraint.</li> <li>• Understand difference between bottom up and Top down assembly.</li> <li>• To develop Assembly model.</li> <li>• Understand concept of Drafting.</li> <li>• Understand different types of view.</li> <li>• Use different engineering symbols</li> <li>• Create Bill of material.</li> </ul>	<p>Various Assembly constraints. Working with bottom up and top down assembly. Design in context. Generating bill of material. Tool Develop &amp; design in CREO PARAMETRIC. Creating various views through wizard. Creating various section views. Add a B.O.M. Adding text and labels. Dimensioning, Various engineering symbols, Translators. Tool Develop &amp; design in CREO PARAMETRIC.</p>	24	16

COURSE NAME: CAM (DELCAM)

COURSE CODE:

COURSE OUTCOMES: The aim of this course student should be able to:

- Understand capabilities of DELCAM Software.
- Create 2D/Wireframe geometric sketches by using DELCAM.
- Understand 3D solid & surface terminology.
- Understand CNC Programming Concept.
- Understand Post processing.
- Execute & generate various Milling, Lathe, EDM operations NC program.

HEORY HOURS:

PRACTICAL HOURS: 80

THEORY MARKS:

PRACTICAL MARKS: 60

UNIT NO.	UNIT NAME	UNIT LEVEL OUTCOMES	CONTENTS (CHAPTERS/TOPICS)	PR HOURS	MARKS	
UNIT I	INTRODUCTION TO DELCAM ENVIORNMENT	At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Understand capabilities of CAM Software like Del CAM Master CAM &amp; UG CAM.</li> <li>• Understand scope of software.</li> <li>• To knowledge various CAM software compare to Del CAM</li> </ul>	Capability of CAM Software and Introduction to Del CAM. Scope of CAM software in Market, advantages of CAM. Introducing CNC machining by using CAM. Distinguish between Various types of CAM software and Del CAM. CAM software features. Concept of hardware & software.	10	8	
UNIT II	WIREFRAME MODELLING	At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>• Understanding 2D drawing.</li> <li>• Create basic geometry.</li> <li>• Execute editing, modification, creating features.</li> <li>• Understand brief Transformation feature.</li> <li>• Understand modify tool.</li> </ul>	Introduction to Del CAM environment. To understanding 2D drawing. Creation of basic geometry like Point, line, rectangle, arc, ellipse, helix, spline & polygon. Selection Methods- Creating Groups / Masking of entities / Assigning / Changing colors. Chain / Window / Area / Group / Delete / Undelete / Undo. Misc. Screen Function - grid / clipboard / view ports / shading / hide / attributes / Creation / renaming / switching between levels / Main level & Visible Level, Transformation of object - Mirror, Rotate, Translate, Scale etc.	10	10	
UNIT III	WORKPLANES	At the end of this Unit the student	Plane concepts - Geometric views, construction planes /	10	12	

		<p>should be able to:</p> <ul style="list-style-type: none"> <li>• Understand Plane concept.</li> <li>• Understand Wireframe 3D modeling.</li> <li>• Create surface modeling by use modification &amp; editing surface feature.</li> <li>• Create Drafting with all Engineering symbols &amp; dimensions.</li> </ul>	Construction depth Z level setting, 3D construction plane. Wireframe Modelling : 3D Wireframe, normal, entity, rotated, named, number			
UNIT VI	SURFACE MODELLING & SOLID MODELLING	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understands surface Terminology</li> <li>• Create surface 3D models By Using Surface Tools.</li> <li>• Understand solid terminology</li> <li>• Create 3D solid modelling by using creating , editing &amp; modify tools</li> <li>• Understand concept of drafting.</li> <li>• Execute Drafting by using various Drafting tools.</li> </ul>	Surface terminology , Types, creating of surfaces, Lofts, ruled, revolved, sweep and draft surfaces, From solid, coons; Solid terminology - Creation of solids extrude, revolve, lofts, sweep, solids manager, fillet, chamfer, solids editing, trim, Boolean operations, shell, draft etc. Creating drafting : dimensions/ drafting note/ freestanding witness / leader lines / attributes / Editing drafting text/ Creating hatch /Smart mode function to create a layout of different part views/ Layout view selection / dimensioning.	10	8	
UNIT V	3D TOOL PATH GENERATION - FINISH	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand surface roughing methods.</li> <li>• Execute 3D Machining surface finish Method</li> <li>• Check surface &amp; related parameters.</li> <li>• Understand using drive &amp; check surface/Solids and related parameters.</li> </ul>	3D machining surface roughing methods. - Radial/plunge / contour / flow line/ Rest Mill for 3D Surfaces And Solids / Using drive and check surfaces and related parameters - plunge and retract moves About tool containment boundaries. 3D machining surface finishing methods : Project , Flow line, Pencil, Leftover, tool paths for 3D Surface And Solids, Using drive and check surfaces/ Solids and related parameters - plunge and retract moves About tool containment boundaries etc.	20	10	
UNIT VI	NC UTILITY & MACHINING OF JOB WITH NC PROGRAMS	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand 2D tool path generation.</li> <li>• Understand concept of CNC machining.</li> <li>• Perform &amp; execute generate various milling &amp; Lathe operations.</li> <li>• Understand Post processing.</li> </ul>	Post Processing: Generating NC / NC Files / Editing NC Files / Verification and simulation - back plot / Solid NC Verification of material cutting and simulation .DNC Data I.e. NC Program Transfer to machine. Program generation for actual machining / verification / post processing / Job machining on CNC Milling Machine DMU 50 T	20	12	

		<ul style="list-style-type: none"> <li>Understand NC program Transfer to machine.</li> </ul>			
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COURSE NAME: Fundamental of Tools & Dies

COURSE CODE:

COURSE OUTCOMES: After completion of course Student should be able to:

- Understand various type Tool & Die
- Understand construction, Functions, specification of Press tool, Mold tool and Die Casting die.
- Select Jigs & fixtures, Press tool and Mold Tool.
- Understands Manufacturing Considerations.
- Calculate manufacturing parameters used in Press tool, Mold tool and Die Casting die manufacturing.
- Understand & Read Assembly Design.
- Explain assembly procedure of Jigs & Fixture, press tool, Mold and Die Casting Die.

THEORY HOURS: 40

PRACTICAL HOURS: 120

THEORY MARKS: 60

PRACTICAL MARKS: 60

UNIT NO	UNIT NAME	UNIT LEVEL OUTCOMES	CONTENTS (CHAPTERS/TOPICS)	TH HOURS	MARKS
UNIT I	Jigs & Fixture	At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>Understand various types of tool &amp; Die.</li> <li>Understand various tool &amp; die manufacturing processes.</li> <li>Define Jigs &amp; Fixtures.</li> <li>Conceive the Purposes use of Jigs &amp; fixtures.</li> <li>State Design consideration for jigs &amp; fixtures.</li> <li>Illustrate the Various Method of Locating, Clamping &amp; Supporting of job in Jigs &amp; Fixture.</li> <li>Understand Manufacturing Considerations.</li> </ul>	Introduction of tool & Die Manufacturing, Different Types of Tool & Dies Definition Of Fixture And Jig, Purpose Of Using Fixtures And Jigs, Fundamental Principle of Jigs & Fixture Design, Types of Jigs & Fixture, Components of Jigs & Fixture, Locating, Supporting and Clamping of jobs in jigs and fixtures, Different Methods Used for Locating & Clamping.	6	8
UNIT II	Press tool	At the end of this Unit the student should be able to: <ul style="list-style-type: none"> <li>Understand construction &amp; Working Terminology of press tool.</li> <li>Knowledge of press tool element &amp; their functions.</li> <li>Understand Specifications &amp; Manufacturing</li> </ul>	Introduction, Press Working Terminology, Elements of Presses, Types of Presses, Press Working Operations, Basic Concept & construction Of Press tool, Element Of Press tool, Functions of Press tool Elements like Shanks, punches, Stripper, Stoppers, Dies, Dies Sets etc. Specification & Manufacturing Parameters of	6	10



		Parameters of Press tool.	Press tool Element.			
UNIT III	Manufacturing concept Of Press Tool	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand &amp; Read Assembly Design.</li> <li>• Demonstrate assembly of press tool.</li> <li>• Understand machine consideration for manufacturing of Press tool</li> <li>• Knowledge of Manufacturing Process Planning,</li> <li>• Understand Priority of Operations.</li> <li>• Understand Maintenance need.</li> <li>• Understand &amp; follow Safety.</li> </ul>	Introduction & concept of Manufacturing Of Press Tool Assembly & Parts Design concept in tools, Assembly of Die, Stripper, and Punch Plate for Jig Boring, Machine Considerations for manufacturing like Horsepower, Size limitations, Weight limitations, Cutting Tools, Special Machinery, equipment available for Manufacturing Process Planning, Operation Sequence, Preparatory Operations, Machine & Process, Maintenance, Safety & Storage Dimensional Tolerances, Material Limitations, Press tool materials.	8	12	
UNIT IV	Mold	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand construction &amp; working of Mold.</li> <li>• Knowledge of various Mold Operations.</li> <li>• Understand Element of Mold &amp; their Functions.</li> <li>• Illustrate various Ejection, Injection, Feed, Standard mold Systems.</li> <li>• Knowledge of design parameters.</li> </ul>	Introduction of mold, Construction of Mold & basic terminology, Types of Mold & Molding operations, Element of Mold & Their Functions, Mold Cavities & Core, Ejection Systems, Feed systems, Parting surfaces, Mold Cooling, Standard Mold System, Design parameters related to Mold, Material, Machine.	6	8	
UNIT V	Manufacturing Concept of Mold	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand &amp; Read Assembly Design.</li> <li>• Demonstrate assembly of press tool.</li> <li>• Understand machine consideration for manufacturing of Press tool</li> <li>• Knowledge of Manufacturing Process Planning.</li> <li>• Develop mold tool manufacture plan</li> <li>• Understand Priority of Operations.</li> <li>• Understand Maintenance need.</li> <li>• Understand &amp; follow Safety.</li> </ul>	Introduction & Manufacturing concept of Molding operation, Material Handling, Estimation Parameters of Mold, Machine & Process, Maintenance, Safety & Storage, Specification of Mold, Material & Machine, Machine Considerations for manufacturing like Horsepower, Size limitations, Weight limitations, Cutting Tools, Special Machinery, equipment available for Manufacturing Process Planning, Operation Sequence, Preparatory Operations.	6	10	

UNIT VI	Die Casting Dies	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand principles of die casting dies.</li> <li>• Define Hot-Chamber &amp; Cold-Chamber Machines Specification.</li> <li>• Understand element &amp; their functions of Die Casting Die.</li> <li>• Understand &amp; Read Assembly Design.</li> <li>• Demonstrate assembly of press tool.</li> <li>• Understand Maintenance need.</li> <li>• Understand &amp; follow Safety.</li> </ul>	<p>Introduction of Principles Die Casting Dies &amp; Machines, Hot-Chamber &amp; Cold-Chamber Machines, Specification of Hot-Chamber &amp; Cold-Chamber, Concept of Die casting Die, Types of Dies, Element &amp; Functions of Die Casting Dies, Injection pressure system, Die Locking Mechanism, Ejection System, Machine, Selection, Surface Finish, Material Handling, Estimation Parameters of Mold, Machine &amp; Process, Maintenance, Safety &amp; Storage, Dimensional Tolerances, Material Limitations, Specification &amp; Manufacturing Parameters of Die casting die Element.</p>	8	12	
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COURSE NAME: Rapid Prototyping (Additive Manufacturing).

COURSE OUTCOMES:

After completion of course Student should be able to

- Understand rapid prototyping technology.
- Describe various parts of rapid prototyping machine
- Understand concept of stereo lithography, two laser system, solid object UV.
- Identify suitable material for LOM, FDM manufacturing techniques
- Understand concept of SLS, EBM etc.

THEORY HOURS: 40

PRACTICAL HOURS:

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH(Hr.)	Marks	
UNIT-I	Rapid Prototyping	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand rapid prototyping technology.</li> </ul>	Historical Development, Applications: Design, Planning, Manufacturing and Tooling, Applications: Automotive, Jewelry, Coin and Bio-Medical, Fundamentals of Rapid Prototyping, Design Process, Rapid Prototyping Process Chain.	08	10	
UNIT-II	Sub-system of RP machine	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Describe various parts of rapid prototyping machine</li> <li>• Create 3-D CAD models to be manufactured by rapid prototyping technique.</li> <li>• Create scan path generation algorithms.</li> </ul>	Subsystems of RP machine: Optical System, Mechanical Scanning System, Computer Interfacing hardware, DAQs, Signal Flow, 3D Model to RP Prototype Introduction to 3D Modeling Software's (AUTOCAD, CREO) Slicing and Scan Path Generation Algorithms Data Conversion and Transmission File Formats, IGES, STL Preprocessing and Post-processing	08	12	

UNIT-III	Liquid based rapid prototyping systems	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand concept of stereo lithography, two laser system, solid object UV.</li> </ul>	Materials used, Stereo lithography, Solid Ground Curing, Solid Object UV (Ultra-Violet) Printer, Two Laser System, Micro-stereo lithography	08	12	
UNIT-IV	Solid based rapid prototyping systems	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand concept of LOM, FDM, and MJM.</li> <li>• Identify suitable material for LOM, FDM manufacturing techniques.</li> </ul>	Materials used, LOM (Laminated Object Manufacturing) System, FDM (Fuse Deposition Modeling) System, Multi-Jet Modeling (MJM) System, Model Maker and Pattern Master, Shape Deposition Manufacturing Process	08	14	
UNIT-V	Powder based rapid prototyping systems	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand concept of SLS, EBM and MJS etc.</li> </ul>	Materials used, SLS (Selective Laser Sintering), (3DP) Three-Dimensional Printing, (EBM) Electron Beam Melting	08	12	

COURSE NAME: 3D Scanning & 3D Printing

COURSE OUTCOMES:

After completion of course Student should be able to

- Understand 3D Scanning technology.
- Understand 3D Printing technology.
- Describe various parts of 3D Scanning & 3D Printing machine.
- Understand procedure of 3D Scanning & 3D Printing.
- Understand concept Reverse Engineering.
- Understand various material used for 3D Printing technology.

THEORY HOURS: 40

PRACTICAL HOURS: 80

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH(Hr.)	Marks	
UNIT-I	3D Scanning (Reverse Engineering)	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand 3D Scanning Technology.</li> <li>• Describe various part of 3D scanning.</li> <li>• Describe types of 3D scanner.</li> </ul>	Overview Of Rapid prototype , Manufacturing Technology, Traditional Process, Application Introduction To 3D scanning: Definition, Classification 3D Scanning, History, Application, Environment of scanning, Mouse function, Import and Export the file, Scanning machine, Scanning Object, Scanning Parameter.	08	10	
UNIT-II	3D Scanning (Reverse Engineering): Preparation of DATA	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Understand the data preparation.</li> <li>• Create the CAD model from point cloud data.</li> <li>• Understand the data preparation software (Idea Maker)</li> </ul>	Capturing the cloud data, Synthesizing the model with overlap, Creating CAD model from the cloud data, Cleaning the model, Introduction of idea maker, Import and Export the file, scale, Define required parameter, Capabilities of 3D printing, calibration, Procedure 3d print.	07	10	

UNIT-III	Material Behavior and selection	<p>At the end of this Unit the student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand concept of elastic and plastic deformation</li> <li>• Identify and select suitable material for product design.</li> <li>• Understand manufacturing characteristic of metals.</li> </ul>	<p>Elastic and Plastic deformation- Mechanism of Plastic deformation-yield stress and shear strength- Perfect and Real crystals- Effect of strain rate and temperature on plastic behavior- Super plasticity- Deformation of non-crystalline materials- Material selection- Cost and service requirement- Recycling- Selection of material for mechanical properties- Strength, toughness and fatigue- Material selection for durability and surface wear and Corrosion resistance- Functional relation between materials and processing- Manufacturing characteristics of Metals- Material selection charts and other aids material selection for aero, auto and nuclear application-Structural Product analysis-End Use behavior – Tooling in product design- Case studies in material selection.</p>	10	15	
UNIT-IV	3D Printing	<p>At the end of this unit student should be able to:</p> <ul style="list-style-type: none"> <li>• Describe various parts of 3D printing (rapid prototyping machine).</li> <li>• Create 3-D CAD models to be manufactured by rapid prototyping technique.</li> <li>• Create scan path generation algorithms.</li> </ul>	<p>Subsystems of RP machine: Optical System, Mechanical Scanning System, Computer Interfacing hardware, DAQs, Signal Flow, 3D Model to RP Prototype Introduction to 3D Modeling Software's (AUTOCAD, CREO), Slicing and Scan Path Generation Algorithms, Data Conversion and Transmission, File Formats, IGES, STL, Preprocessing and Post-processing. Hand on Practice on 3D Printing Machine (FDM).</p>	15	25	

COURSE NAME: ENTREPRENEURSHIP

COURSE CODE:

COURSE OUTCOMES:

After completion of course Student should be able to

- Understand Enterprise Registration.
- Understand Business Skills - Motivation and Leadership
- Apply Managerial Accounting.
- Apply Financial Analysis and Planning.
- Effective Communicate.

THEORY HOURS:

PRACTICAL HOURS:

20

THEORY MARKS:

PRACTICAL MARKS:

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR Hrs.	Marks	
UNIT-I	Introduction to Entrepreneurship & Enterprise Registration.	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Define entrepreneurship</li> <li>• Demonstrate the qualities of successful entrepreneur</li> <li>• List the benefits of being an entrepreneur</li> <li>• Identify challenges faced by entrepreneurs</li> <li>• List the various types of enterprises</li> <li>• Identify the best model for registration for the particular enterprise</li> <li>• Execute registration of an enterprise under various legislations including PAN, VAT, and service tax.</li> </ul>	Entrepreneurship, Qualities of a successful entrepreneur, steps to being your business. Process of setting up a business enterprises, Choosing the type of organization, Registering a business, Pan registration, Vat registration, Service tax registration, Companies act registration, Factories Act registration, Check your understanding, References for further reading	03		
UNIT-II	Business Skills - Motivation and Leadership & Book keeping Inventory and Working Capital	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>• Explain what is motivation</li> <li>• Explain Maslow's hierarchy of needs</li> <li>• Discuss the factors that motivate MSME entrepreneurs;</li> <li>• Plan SMART goals</li> </ul>	Motivation and need fulfilment, Factors that motivate MSME, Entrepreneurs, Leadership-meaning and styles. Types of vouchers, Payment method receipt vouchers, Invoice or bill, Journal voucher, Supporting documents, Separate book for self.	04		

	Management	<ul style="list-style-type: none"> <li>• Demonstrate effective leadership's skills.</li> <li>• Explain Book keeping.</li> <li>• Explain Inventory Management</li> <li>• Working Capital Management.</li> </ul>	<p>Objective, Meaning of inventory, Inventory levels, Costs of inventory, Managing inventory, Reorder level.</p> <p>Working capital, Working capital management, Sales on cash and credit, Cash and purchases, Managing creditors, Working capital management, Funding of working capital, Product pricing Types of pricing, Check your understanding</p>			
UNIT-III	Effective Communication & Managerial Accounting.	<p>At the end of this unit student should be able to:</p> <ul style="list-style-type: none"> <li>• Define communication</li> <li>• List the various ways to communicate</li> <li>• Explain the communication process</li> <li>• Identify various barriers to communication</li> <li>• Demonstrate the effective communication.</li> <li>• Explain the basic principles of accounting</li> <li>• List the various books of account</li> <li>• Explain the meaning of final account</li> <li>• Compare the profit and loss account</li> <li>• Analyses the balance sheet</li> <li>• Examine the cash flow statements.</li> </ul>	<p>What is communication, Forms of communication, Class. On the basis of number of senders and receivers, Activity, Class. On the basis of number of modes of communication, Barriers to communication, Overcoming barriers and, communicating effectively, Check your understanding, References for further reading.</p> <p>What is accounting, Why accounting basic principles of accounting ,Debit and credit, Basic principles, Accounting head , Income, Expenses, Assets, Liabilities, Books of account, Final account, Profit and loss statement, Balance sheet, Cash flow statement, Check your understanding, References for further reading.</p>	04		
UNIT-IV	Financial Analysis and Planning & Introduction to Developing a Business Plan.	<p>At the end of this unit student should be able to:</p> <ul style="list-style-type: none"> <li>• Understand the Financial Statements and Analysis</li> <li>• Understand Ratio Analysis</li> <li>• Understand Budget Planning and Analysis</li> <li>• Explain the meaning of the term "business plan"</li> <li>• List the features of a business plan</li> <li>• •Develop and write a business plan</li> </ul>	<p>Primary financial statements, Financial statement analysis, techniques of analysis, Ratio analysis – classification of ratios, liquidity ratios, current ratio, acid test ratio, profitable ratios, gross profit margin ratio, net profit margin ratio, leverage ratios, debt equity ratio. Leverage ratio, Efficiency Ratio.</p> <p>Budgeting and its benefits, annual planning for business, planning cycle, create budget, review budget, concept of planning, planning process, approaches to planning, decision making.</p> <p>Developing a business plan, need for plan, concept, steps, business viability and</p>	04		



			justification, tips for preparing effective business plan.			
UNIT-V	Compliances & Introduction to Credit linkage	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>•Taxation – Income Tax, Excise, Sales Tax</li> <li>•Export import licensing</li> <li>•Companies Act</li> <li>•Labor laws</li> <li>•Factories Act.</li> <li>•explain the various stages of business</li> <li>•infer the stage of your business</li> <li>•identify the types of finance one can avail at various stages</li> <li>•list the basic requirements for availing different types of finance</li> </ul>	Process of setting up a business enterprise, various types of forms for filing IT return, steps of e-filing IT returns, advance tax, tax deducted at source, ACES, export/ Import license, Pvt. limited company compliances. Financing for various business stages, sources of funding, basics of bank financing, classification of loans, special offering for SMEs, Challenges faced in finance, credit rating, CIBIL Score, Govt. schemes, Capital Market.	03		
UNIT-VI	Marketing.	At the end of this unit student should be able to: <ul style="list-style-type: none"> <li>•differentiate between marketing and Sales</li> <li>•perform SWOT Analysis</li> <li>•devise the Marketing Mix for their products</li> <li>•explain the characteristics of MSME marketing</li> </ul>	Power of marketing, know your business-SWOT Analysis, and Know your customer, design your marketing mix, scale strategy after the sale, review and revision of business strategy.	02		

COURSE NAME: PROJECT WORK

COURSE CODE:

COURSE OUTCOMES:

After completion of course Student should be able to

- Understand clearly the Product design parameters.
- Design against standard and parameters
- Apply design principles to specific problem
- Interpret of output and confirming to specifications
- Collecting data related to design and manufacturing.
- Communicate with manufacturing line.

THEORY HOURS:

PRACTICAL HOURS: 120

THEORY MARKS: 60

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR Hrs.	Marks	
UNIT-I		At the end of this unit student should be able to: <ul style="list-style-type: none"><li>• Understand clearly the Product design parameter.</li><li>• Apply the various processes for product design &amp; development.</li><li>• Understand the concept of 3D scanning &amp; 3D Printing.</li><li>• Understand the CAD/CAM Software like AUTOCAD, SOLIDWORK, and DELCAM.</li></ul>	Project on Design & development of product using CAD software, practical exposure of design & development of product using 3D printing (FDM) machine.	120	60	