



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Mechanical Engineering (CAD/CAM)

Course Code: DI03065021

Course Name: 3D Modelling Practice

| | |
|--------------------------------|---------------------------|
| w. e. f. Academic Year: | 2024-25 |
| Semester: | 3 rd |
| Category of the Course: | Professional Core Courses |

| | |
|----------------------|--|
| Prerequisite: | Computer system with latest configuration, Laser printer, Related software. (Any parametric modelling software like Pro-E, Solid Edge, SolidWorks; Autodesk Inventor, Fusion-360). |
| Rationale: | <p>Mechanical engineers are responsible for designing and manufacturing a wide range of products, from small components to complex machines. In order to do this effectively, they need to be able to create and interpret 3D models of engineering parts and assemblies.</p> <p>Parametric solid modelling software is a powerful tool that allows engineers to create and modify 3D models quickly and easily. Parametric software uses constraints to link geometric features together, so that when one feature is changed, the other features are updated automatically. This makes it easy to make changes to designs without having to start from scratch.</p> <p>In addition to its power and flexibility, parametric solid modelling software is also widely used in industry. This means that students who learn to use this software will be well prepared for jobs in the mechanical engineering field.</p> <p>The course will teach students the fundamentals of parametric solid modelling using any popular parametric solid modelling software. Students will learn how to create and modify 3D models of engineering parts and assemblies, create engineering drawings from parametric Models</p> |

Course Outcome:

After Completion of the Course, Student will able to:

| No | Course Outcomes |
|----|---|
| 01 | Recall basics of AutoCAD 2D and apply tools to create 3D Models in AutoCAD |
| 02 | Apply parametric CAD software tools to create 2D production drawings using the sketch module, incorporating Geometric Dimensioning and Tolerancing (GD&T) principles. |
| 03 | Apply parametric modeling techniques to design 3D mechanical components and assemblies using industry-standard software. |
| 04 | Develop precise engineering drawings and comprehensive documentation from parametric models/assemblies. |



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Teaching and Examination Scheme:

| Teaching Scheme (in Hours) | | | Total Credits L+T+ (PR/2) | Assessment Pattern and Marks | | | | Total Marks |
|-------------------------------|---|----|------------------------------|------------------------------|-------|----------------------|---------|-------------|
| L | T | PR | C | Theory | | Tutorial / Practical | | |
| | | | | ESE (E) | PA(M) | PA(I) | ESE (V) | |
| 0 | 0 | 6 | 3 | 0 | 0 | 20 | 30 | 50 |

Course Content:

| Unit No. | Content | No. of Hours | % of Weightage |
|----------|---|--------------|----------------|
| 1. | <p>3D solid modeling- I (AutoCAD)</p> <p>Recall the basic 2D modelling commands of AutoCAD and sketch basic component. Introduction to 3D Modelling in AUTOCAD Create and modify 3D models of mechanical components using AUTOCAD. Select Mechanical Components: Each student will select three mechanical components of moderate complexity to model. Students will submit the completed models in relevant file format.</p> | 10 | 10 |
| 2. | <p>3D solid modeling- II (Parametric 2D Sketch)</p> <p>Navigate the user interface of a popular parametric modeling software package (e.g., SolidWorks, Autodesk Inventor, or PTC Creo). Configure settings and preferences for efficient modeling. Overview of essential tools and commands for creating parametric solid models. GD&T Basic concepts in 2D Production drawings. (Tolerances, Limits, Feature Control Frame, symbols etc.) Create and modify 2D sketches of mechanical components using Parametric Software. Select Mechanical Components: Each student will select three mechanical components of moderate complexity to model. Include icons, general settings command manager, sketch module, constraints, 2D editing/modify commands, navigating tools, templates etc. Students will submit the completed models in relevant file format.</p> | 10 | 10 |



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|--------------|--|-----------|------------|
| 3 | <p>3D solid modeling- III (Parametric 3D Models) Construct and modify 3D models of mechanical components using Parametric Software. Select Mechanical Components: Each student will select five mechanical components of moderate complexity having engineering features to model. Students will submit the completed models in relevant file format.</p> | 14 | 16 |
| 4. | <p>3D modeling- IV (Sheet Metal) Introduction to basic sheet metal tools in parametric software. Create sheet metal parts (any two) from the flattened state, add features like flanges and bends, and convert existing solid parts to sheet metal. Students will submit the completed models in relevant file format</p> | 14 | 16 |
| 5. | <p>3D modeling- V (Part Modelling and Assembly) Introduction to parametric assembly environment. Use types of mates with examples. Prepare any one simple mechanical assembly comprised of 4-5 mechanical parts having engineering features. Students will submit the completed models in relevant file format individually</p> | 14 | 16 |
| 6. | <p>Documentation/ Presentation (Assembly Drawing) Introduce basic tools for drawing and settings prior to creation of drawing, templates, sheet sizes, different views, display styles, scale and other related settings including title block. Create drawing from model/assembly comprising of BOM, tables, annotations, text, balloons, etc. Include 3 basic views along with isometric/assembly and prepare printable sheet in pdf. Students will submit the completed drawing in relevant file format</p> | 14 | 16 |
| 7. | <p>Mini Project Assign any one project which includes part modelling, assembly and documentation Example: Cotter Knuckle Joint, Wheel Base Assembly etc. Teacher will assign mini project in 4-5 group of students. Students will submit the completed models in relevant file format.</p> | 14 | 16 |
| Total | | 90 | 100 |

References/Suggested Learning Resources:

(a) Books:

1. Practical Autodesk AutoCAD 2023 and AutoCAD LT 2023
2. Engineering Design with SolidWorks

(b) Open-source software and website:

1. Autodesk Inventor
 - Autodesk Inventor Learning Center: <https://www.youtube.com/watch?v=iCnVZrzz1VI>



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- Autodesk Inventor Documentation: <https://www.autodesk.com/support/technical/product/inventor>
- Autodesk Inventor Tutorials: <https://www.youtube.com/watch?v=KKbwf2a53bA>
- 2. Dassault Systems SolidWorks
 - SolidWorks Tutorials: <https://www.youtube.com/watch?v=E69EqFY2qMc>
 - SolidWorks Tutorials: <https://www.youtube.com/watch?v=CiBwrjUeB8U>
 - SolidWorks Help Center: <https://www.solidworks.com/support/home>
- 3. PTC Creo Parametric
 - PTC Learning Community: <https://community.ptc.com/>
 - PTC Creo Parametric Tutorials:
 - https://support.ptc.com/help/creo/creo_pma/r10.0/usascii/tutorials_pma/pma_tutorials.html
 - PTC Creo Parametric Documentation:
 - <https://support.ptc.com/images/cs/articles/2018/05/1525425932uNM3/tkuse.pdf>
- 4. Fusion 360
 - Autodesk Fusion 360 Learning Centre: <https://help.autodesk.com/view/fusion360/ENU/courses/>
 - Fusion 360 Tutorials: <https://www.youtube.com/watch?v=qvrHuaHhqHI>
 - Fusion 360 Help Centre: <https://help.autodesk.com/view/fusion360/ENU>

List of Laboratory/Learning Resources Required:

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to use in uniformity of practical in all institutions across the state.

| Sr.No. | Equipment Name with Broad Specifications | PrO. No. |
|--------|--|----------|
| 1 | Computer system with latest configuration. | All |
| 2 | Laser printer - plotter of A2/A3/A4 size. (any) | All |
| 3 | Related software. (Any parametric modeling software like Pro-E, SolidEdge, SolidWorks; Autodesk Inventor, Fusion-360). | All |

Suggested Project List:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the current semester, the micro-projects are group-based (group of 3 to 5). The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. The duration of the micro project should be about 14-16 (fourteen to sixteen) student engagement hours during the course. The students ought to submit micro-project by the end of the semester. A suggestive list of micro-projects should be given. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:



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Refer Following Few Examples

| | | | |
|--------------------|------------------------|---------------------|-------------------|
| Butterfly Valve | Wheel Base Assembly | Simple Steam Engine | Cotter Joint |
| Steam Stop Valve | Cam-Follower Mechanism | Fixture Assembly | Vibration Shocker |
| Lathe Machine Vice | Canon Assembly | Knuckle Joint | Foot Step Bearing |

Suggested Activities for Students: If any

1. Bring Actual mechanical assembly from industry/real life/scrap shop/garage/etc. (made up of at least 4 to 5 mechanical components), dismantle the same, measure dimensions and sketch it to use the same for project
2. Visit design section of different industry and observe various hardware and software, procedure, standards they are following for designing a product.

Any Other:

Other than the laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in groups and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews.

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- Guide students on addressing the issues on environment and sustainability using the knowledge of this course
- Guide students for keeping the drawings in digital form and reduce use of paper.

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