GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree – 3 D Printing
Subject Code: N115AN02
Semester – V(w.e.f. AY 2025-26)
Subject Name: Solid Modelling

Prerequisite: None

Rationale:
3D models means solid model is usually originated on the computer by engineer using some kind of solid modeling software. Solid modeling is a process of developing a mathematical representation of any 3D object. Solid models are often animated for some uses. Today 3D models are used in wide variety of engineering fields for visualization and analysis. 3D computer graphics are widely used for product design, assembly design etc. A Professional Engineer and students should have the knowledge of solid modeling software to visualize the machine components & assembly like cars, machine tools and earth movers etc,. Solid modeling is the expertise is the current requirement of the Industry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	100
3	0	4	5	70	0	30	-	

Content:

Sr. No.	Content	Total Hrs.
1	**Introduction to Solid Modeling:** Introduction, Applications, Benefits, Need, Hardware Requirements, Different Software packages used for Solid Modeling. Understanding features of modeling software.	7
2	**Working in 2 D environment:** Working in Sketcher mode – Line, Profile, Circle, Arc, Rectangle and their sub options. Constraints - Dimensioning constraint, Geometrical constraint.	10
3	**Working in 3D environment:** Intersection of solids, Design of Solids: Solid entities, Boolean operations, B-rep of Solid Modeling, CSG approach of solid modeling, Advanced modeling methods. Creating 3D Solid Models.	10
4	**Assembly:** Reading top-down and bottom-up assemblies, Placement constraints, Assembly Drawing - Preparation of Assembly drawing by using assembly features. (Assembly of minimum 4-5 Engineering components) Exploded view – Explode the assembly.	8
5	**3D Printing Data Formats:** CAD Data exchange formats , Tessellated Models, STL Format, STL File Problems, STL File Manipulation and Slicing/Repair Algorithms, AMF files,	8

	3MF, XML, Meta Data, PLY, STEP for AM Application Protocols (AP).	
6	**3D Printing Data Processing:** Part Orientation and Support Structure Generation, Model Slicing and Contour Data Organization, Direct and Adaptive Slicing, Hatching Strategies and Tool Path Generation.	5

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	25	25	--	---

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Course Outcomes:

At the end of the course, student should be able to:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Make use of the engineering modelling software.	20
CO-2	Interpret 2-D and 3-D Engineering modelling.	30
CO-3	Dissect assembly modelling.	30
CO-4	Analyze 3-D printing data.	20

Reference Books:

1. David F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", TMH, 2008.
2. Anupam Saxena, Birendra Sahay, "Computer Aided Engineering Design", Springer, 2005.
3. Michael E. Mortenson, "Geometric Modeling", Wiley, NY, 1997.
4. Ian Stroud, Hildegarde Nagy," Solid Modelling and CAD Systems", Springer, 2011

List of experiments:

1. Introduction to Solid Modeling Packages
2. Working with sketch mode of Solid modeling Package
3. Working with modeling tools.
4. Working with Surface modelling.
5. Working with advanced modeling tools.
6. Assembly modeling using appropriate assembly constrains.
7. Working with CAD Data Exchange formats: IGES, ACIS, DXF STL, AMF

8. Identification of STL file problems using MAGICS (or any open source) Software
9. Part orientation, support and Tool path generation in CURA (or any open source) Software.
10. Case study on 3D Modelling and data processing for 3D printing.