| | |
|---|---|
| Course Title: **Parametric Lab** | Course Code: **15AT55P** |
| (L:T:P) :**0:2:4** Credits **:3** | Core/ Elective: **Core** |
| Type of course: **Tutorial/Practical** | Total Contact Hours: **78** |
| CIE :25 Marks | SEE: 50 Marks |

**Prerequisites:**

**Basic knowledge of Computer operation and Engineering drawing studied in the previous semesters.**

**Course Objectives:**

To learn the concepts of computer aided solid modeling and its applications in the field of Automobile and mechanical product design process.

*On successful completion of the course, the students will be able to attain CO:*

| Course outcomes | | CL | Linked experiments | Linked PO | Teaching Hrs |
|---|---|---|---|---|---|
| **CO1** | Explain the need, common terms and work benches of parametric modeling software with installation process. | U/A | UNIT-I | 2,8,9, 10 | 06 |
| **CO2** | Practice on efficient use of CAD software sketch/draw tools and interface to create constrained sketches/ profiles. | U/A | UNIT-II | 2,3,4,8, 9,10 | 06 |
| **CO3** | Practice on efficient use of CAD software part modeling tools and interface to create constrained 3D parts. | U/A | UNIT-III | 2,3,4,8, 9,10 | 12 |
| **CO4** | Practice on efficient use of CAD software assembly modeling tools and interface to create constrained 3D assemblies. | U/A | UNIT-IV | 2,3,4,8, 9,10 | 06 |
| **C05** | Practice on creating different 3D part models of different Automobile /mechanical components using CAD software tools. | U/A | UNIT-II &V | 2,3,4,8, 9,10 | 30 |
| **C06** | Practice on creating different 3D assembly models and drawings of different Automobile/mechanical components using CAD software tools. | U/A | UNIT-IV & VI | 2,3,4,8, 9,10 | 18 |
| | **Total sessions** | | | | **78** |

## COURSE PO ATTAINMENT MATRIX:

| Course | Programme Outcomes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 |
| **Parametric modeling** | - | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 |

Level 3-Highly Addressed, Level 2 Moderately Addressed , Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the CO's which address the given PO.
If > 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at level 3.
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2.
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed Level 1.
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## Course Delivery:

The course will be delivered through Tutorials, demonstration, hands on practice and activities.

## Course Content:

### Unit I: Introduction to Parametric modeling:

Computer aided Design & Drafting-concept-merits-types, Parametric modeling-concept-merits, Hardware requirements-software requirements, installation process, terms used in parametric modeling software-geometry relationships-assembly relationships, constraints-concept-need-types, parametric modeling software work benches-concept-types-functions of each type.

### Unit II: Creating profiles/sketches:

Sketcher workbench-concept-different parts of user interface, sketch/profile tools- line-circle-ellipse-arcs-rectangles- polygons- curves- fillets- chamfer, Display tools-Zoom-pan-rotate, geometric relationships-Dimensions, measuring sketched entities-Distance-Area-Area properties, Editing-trim-extend-corner trim-split- offset- move- rotate- mirror- scale- stretch.

### Unit III: Part modeling tools:

Conversions of 2D profiles into 3D models-using extrude/protrude and revolve commands. Cutouts/shell creation, placing holes, rounds/fillets, champers, creating rectangular and circular array/patterns, array/patterns along a path/curve, mirroring features, editing of a model, creating internal and external threads. Adding draft, ribs, thin wall features, lip to models. Creating vents, boss. Creating swept and lofted models.

### Unit IV: Assembly modeling and drafting tools:

Know the assembly environment, setting the assembly environment, types of assembly design approach-bottom-up and top-down assembly, Creating assembly and sub-assemblies, Applying assembly relationships, Editing and modifying assembly relationships, interference detection in assemblies.
Drafting environment-drawing views-types-options-generating each type of view-adding annotations-Creating exploded view of the assembly-creating balloons and parts list.

**Unit V: Creating mechanical/Automobile components in part modeling work bench:**

**Create following mechanical/Automobile parts using part modeling work bench tools.**

1. Square nut and bolt
2. Hexagonal nut and bolt.
3. Spur gear.
4. Helical gear.
5. Piston.
6. Crankshaft.
7. Open ended exercise.

**Unit VI: Assembly modeling and drafting:**

Create following Assemblies and their drawings using assembly modeling work bench and drafting workbenches respectively.

1. Muff coupling
2. Unprotected flanged coupling.
3. Knuckle joint.
4. Connecting rod.
5. Universal joint
6. Plumber block
7. Screw jack
8. Open ended exercise

**Note:**

1. Open ended experiments have to be performed using the skills learnt in the Laboratory.
2. These experiments could be extended versions of the standard experiments.
3. Lecturer should know the end results of open ended experiments and only acts as a guide and students has to establish the procedure and conduct experiments.
4. Example for Open ended experiment-I are Part model of bevel gear, hypoid gear, pinion, rack and cylinder head etc.
5. Example for Open ended experiment-II is Assembly models of Clutch plate, wheel cylinder and injector.

**Course Assessment and Evaluation Scheme:**

| Method | What | | To whom | When/Where (Frequency in the course) | Max Marks | Evidence collected | Course outcomes |
|---|---|---|---|---|---|---|---|
| Direct Assessment | CIE(Continuous Internal Evaluation) | IA | Students | Average of two tests | 10 | Blue books with drawing printouts | 1,2,3,4,5,6 |
| | | | | Average marks of all exercise to be computed | 10 | File containing solid modeling tools explanation and drawing print outs | 1,2,3,4,5,6 |
| | | | | Activity | 05 | Activity Report | 1,2,3,4,5,6 |
| | SEE ( Semester End Examination) | End Exam | | End of the course | 50 | Answer scripts at BTE | 1,2,3,4,5,6 |
| Indirect Assessment | Student Feedback on course | | Students | Middle of the course | | Feedback forms | 1,2,3 Delivery of course |
| | End of Course Survey | | | End of the course | | Questionnaires | 1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods |

**Sample Activities:**

1. Students can visit Computer coaching centers/CAD Centers/ websites and collect information on different paid and FOSS (Free and Open Source Software) CAD/CAM/CAE software with their features and applications.
2. Students can visit computer coaching centers /CAD Centers/ Websites and collect information on new type of part modeling /assembly modeling tools or other work benches like surface modeling, sheet metal, plumbing, electrical etc.
3. Students can visit websites of different CAD/CAM/CAE software and collect information on the process to download trial or student version software.
4. Students can create simple mechanical/Automobile mechanisms using Animation/ mechanism workbench.
5. Students can find stress/strain induced in Materials using FEM workbench.

**Note:**

1. **Student should prepare a report on any one of the above/similar activity, which helps in achieving above course outcomes.**
2. **The report prepared should be approved by the concerned course co-ordinator.**
3. **The activity group should consist of maximum of three students.**

## MODEL OF RUBRICS FOR ASSESSING REVIEWS OF PROJECT FOR CIE

**RUBRICS MODEL**

| Student Name : | | | | Reg No: | | |
|---|---|---|---|---|---|---|
| **RUBRICS FOR ACTIVITY( 5 Marks)** | | | | | | |
| **Dimensio** | **Unsatisfactor** | **Developing** | **Satisfactory** | **Good** | **Exemplary** | **Student Score** |
| | **1 Mark** | **2 Mark** | **3 Mark** | **4 Mark** | **5 Mark** | |
| **Collection of data** | Does not collect any information relating to the topic | Collects very limited information; some relate to the topic | Collect much information; but very limited relate to the topic | Collects some basic informatio n; most refer to the topic | Collects a great deal of information; all refer to the topic | Ex: 4 |
| **Fulfill team's roles & duties** | Does not perform any duties assigned to the team role | Performs very little duties but unreliable. | Performs very little duties | Performs nearly all duties | Performs all duties of assigned team roles | 5 |
| **Shares work equally** | Always relies on others to do the work | Rarely does the assigned work; often needs reminding | Usually does the assigned work; rarely needs reminding | Normally does the assigned work | Always does the assigned work without having to be reminded. | 3 |
| **Listen to other Team mates** | Is always talking; never allows anyone else to speak | Usually does most of the talking; rarely allows others to speak | Talks good; but never show interest in listening others | Listens, but sometimes talk too much | Listens and speaks a fair amount | 2 |
| **Average / Total =marks=(4+5+3+2)/4=14/4=3.5=4** | | | | | | |

**Note: This is only an example for one student. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.**

**Resources**

**Reference books:**

| Sl no | Title of book | author | publisher |
|---|---|---|---|
| 1 | Automobile Engineering Drawing | R B Gupta | Satya prakashan |
| 2 | Machine Drawing | N D Bhatt and V M Panchal | Charotar Publishing |
| 3 | Machine Drawing | K R Gopalakrishna | Subhas Stores |
| 4 | CADD software for Engineers and Designers. | Prof. Sham Tickoo | Dream tech press |

Websites:

https://www.youtube.com/watch?v=37xoOJX2nJ0&list=PLT0PdTF-m3M9Gi1DZAQz2zwGIo3vBQOfj
https://www.youtube.com/watch?v=LbIDqXa085Q
https://www.youtube.com/watch?v=G27An7YpriM
https://www.youtube.com/watch?v=xcDQbD-tjoE

2. **Software**: Any Genuine CADD software or free and open source CADD software.

## LAB EXERCISES

**Note:**

1. All the exercises are ***compulsory.***
2. Students should create the detailed parts and assembly drawings of each parts and assemblies after creating respective part and assemblies.
3. Printouts of each part and assembly drawing are to be kept along with lab file
4. Each drawing should be created with proper border, title block and bill of materials.
5. Detailed drawings of parts should be provided to students.
6. The following drawings should be created after creating respective part models and assemblies.

**Create following mechanical/Automobile parts using part modeling work bench tools.**

1. Square nut and bolt
2. Hexagonal nut and bolt.
3. Spur gear.
4. Helical gear.
5. Piston.
6. Crankshaft.

**Create the following Assemblies (3D) using assembly modeling work bench and their drawings (2D) using drafting work bench.**

1. Muff coupling
2. Unprotected flanged coupling.
3. Knuckle joint.
4. Connecting rod.
5. Universal joint
6. Plumber block
7. Screw jack

## SCHEME OF EVALUATION

### a. Internal evaluation

**Note:**

1. **I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.**
2. **Rubrics to be devised appropriately by the concerned faculty to assess Student activities.**
3. **Student suggested activities report for 5 marks**
4. **Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods**

| | |
|---|---|
| Average of two tests | 10 marks |
| Average marks of all exercise to be computed | 10 marks |
| Activity | 05 marks |
| **Total** | **25 marks** |

**b. Semester End examination**

| Serial no | Description | Marks |
|---|---|---|
| 1 | Parts modeling/open ended exercise-I | 15 |
| 2 | Assembly modeling/open ended exercise-II | 25 |
| 3 | Drafting/ drawing & Print out (5+5) | 10 |
| | **Total** | **50** |

**LAB FACILITIES REQUIRED:**

| SL No | Description of equipment/Tools/Software | Quantity |
|---|---|---|
| 1 | Personnel computer with 17" color LED monitor, Intel core i5 fifth gen processor, 4 GB ram, Graphics card with 2 GB RAM | 20 |
| 2 | Laser jet Printer | 02 |
| 3 | UPS 5KV | 01 |
| 4 | Genuine CADD software / Free and open source CADD software | 01 each |
| 5 | Microsoft Operating systems | 01 each |
| 6 | LCD Projector with HDMI and USB port | 01 |