| CH353 | TINKERING LAB | L | T | P | C | Int | Ext |
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**Semester V [Third Year]**

**COURSE OBJECTIVES:**

1. Develop proficiency in the use of tools, equipment and facilities available in the AICTE IDEA Lab.
2. Understand and apply basic mechanical, electronic and digital fabrication processes for prototyping.
3. Acquire skills to design, build and integrate functional systems/projects, including suitable enclosures using modern fabrication techniques.
4. Foster innovation, creativity and design thinking to solve real-world engineering problems through hands-on learning.

**COURSE OUTCOMES:**

**After successful completion of the course, the students will be able to**

1. explain the working principles of various manufacturing and digital fabrication processes used in the IDEA Lab.
2. design and develop functional prototypes using embedded systems, 3D printing, robotics, IoT and related technologies.
3. operate and utilize IDEA Lab equipment and tools for fabrication, prototyping and testing.
4. apply design thinking and problem-solving skills to convert real-world problems into practical engineering solutions/products.
5. work effectively in teams and demonstrate communication and collaboration skills during project development.

**Laboratory Activities:**

**1. Familiarization with Electronic Circuit Design and PCB Fabrication**

- Schematic design and PCB layout of a suitable electronic circuit.
- Fabrication and testing of the designed circuit.

**2. Hands-on Demonstration of 3D Machining on Soft Materials**

- Machining of simple 3D geometries on soft materials such as soft wood or modelling wax using appropriate machining tools.

**3. Hands-on Demonstration of 3D Scanning and 3D Printing**

- Surface scanning of a geometrical object using a 3D scanner.
- Printing of the scanned geometry or other object using FDM or SLA 3D printing technology.

**4. Hands-on Demonstration of Laser Cutting and Engraving for Press-fit Designs**

- 2D profile cutting for press-fit box/casing designs using Acrylic sheets (3 mm / 6 mm), Cardboard, and MDF board (2 mm).
- 2D profile cutting on plywood/MDF boards (6-12 mm) for press-fit structural designs.

**5. Familiarization with Welding Equipment and Workshop Tools**

- Introduction to welding tools and safety practices.
- Demonstration of basic welding operations.
- Demonstration of various workshop tools and their applications.

**6. Familiarization with Lathe Operations**

- Familiarization and basic operation of Metal lathe.
- Familiarization and basic operation of Wood lathe.

**7. Demonstration and Familiarization of Emerging Technologies**

- Embedded programming using Arduino and/or Raspberry Pi and/or Arm processors.
- Demonstration and working principles of Quadcopters (Drones).
- Familiarization with Electric (EV) Bicycles and their components.
- Familiarization of Robo assembly.

**8. Design and Implementation of a Capstone Project**

- With embedded hardware, software and machined or 3D printing enclosure.
- Documentation and demonstration of the project - submission of a project report and a short video presentation for semester end assessment.