

**Program: All Branches****Group A****F. Y. B. Tech****Semester: II****Course: Ideation and Innovation Laboratory (DJS23FSC151L)****Objectives:**

To provide for an experiential learning opportunity for first-year engineering students, fostering innovation through hands-on activities in electronics, mechanical fabrication, and prototyping. It is expected to encourage critical thinking, teamwork, and real-world problem-solving by integrating design, ideation, and fabrication in a collaborative environment.

Outcomes: Learners are expected to:

1. Demonstrate the ability to identify and use basic electronic instruments and mechanical tools safely and effectively for measurement and testing purposes.
2. Construct, solder, and house electronic circuits by interpreting schematics and applying fabrication skills for functional prototyping.
3. Design and assemble a wired two-wheeled robotic system with motor controls, demonstrating integration of mechanical and electronic components.
4. Simulate electronic circuits using software tools to analyse circuit behaviour and validate theoretical concepts through virtual experimentation.
5. Implement a basic IoT-based system integrated with an Android application to monitor and display real-time data, demonstrating applied problem-solving and programming skills.

Ideation and Innovations Laboratory (DJS23FSC151L)		
Unit	Description	Duration
1	<p>Project-Based Learning Activity 1: Introduction to Tools, Equipment, and Component Identification</p> <ul style="list-style-type: none"> • Objective: To familiarize the learners with laboratory experimentation, design, debugging, and micro-manufacturing tools & equipment through a structured sequence of short instructional videos. • Outcome: Learners engage in a series of guided activities using concise instructional videos to understand the functionality of various instruments. They demonstrate their learning by performing tasks such as recording observations, tabulating readings, and drawing conclusions. The activity covers key instruments including: <ul style="list-style-type: none"> ○ Cathode Ray Oscilloscope ○ Function Generator ○ Multimeter ○ Power Supply ○ Laser Cutter ○ 3D Printer 	08

<p>2</p>	<p>Project-Based Learning Activity 2: Breadboarding, Soldering, and Circuit Housing</p> <ul style="list-style-type: none"> • Objective: To develop hands-on skills in component identification, circuit schematic interpretation, breadboarding, soldering, and circuit housing through a structured learning approach. • Outcome: <ol style="list-style-type: none"> 1. Learners identify and differentiate resistor and capacitor values and types, as well as recognize and utilize an LSI IC (e.g., IC 555). They assemble a 555 timer-based astable multivibrator circuit on a breadboard with a known oscillation frequency. 2. Learners apply soldering techniques by mounting and soldering the evaluated circuit onto a general-purpose PCB and verifying its functionality. 3. A CAD file (.stl format) for the circuit housing is processed into a .gcode file using slicer software, followed by 3D printing of the housing. 4. The circuit is securely mounted within the housing using basic workshop techniques, including cutting, smoothing with a flat file, and fixing components with self-threading screws. 	<p>10</p>
<p>3</p>	<p>Project-Based Learning Activity 3: Wired Two-Wheeled Robot</p> <ul style="list-style-type: none"> • Objective: To introduce learners to the design and operation of a two-wheeled robotic vehicle with a caster wheel pivot, enabling motion control using DC motors and a reversible mechanical switch. • Outcome: <ol style="list-style-type: none"> 1. Learners assemble a two-wheeled robot using a metal chassis, rubber-cushioned wheels, and a single caster wheel for stability. 2. Motion is initiated using geared DC motors, with directional control implemented via a reversible mechanical joystick switch. 3. Learners understand and apply the principles of reversing a DC motor for bidirectional movement. 4. Learners analyze the function of a DC motor speed-reduction gearbox, evaluating its advantages and limitations. 	<p>08</p>
<p>4</p>	<p>Project-Based Learning Activity 4: Circuit Simulation</p> <ul style="list-style-type: none"> • Objective: To introduce learners to circuit simulation techniques enabling them to analyze and verify fundamental electrical circuit theorems. • Outcome: <ol style="list-style-type: none"> 1. Learners explore and demonstrate proficiency in using a circuit simulation tool. 2. They simulate and verify key electrical theorems, including Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL). 3. Learners perform Mesh and Nodal Analysis using simulation-based circuit modeling. 	<p>06</p>

	4. They analyze and validate the Maximum Power Transfer Theorem through simulated circuit behavior.	
5	<p>Project-Based Learning Activity 5: IoT and Android App Development</p> <ul style="list-style-type: none"> • Objective: To introduce learners to the fundamentals of the Internet of Things (IoT) and Android-based application development. • Outcome: <ol style="list-style-type: none"> 1. Learners explore the IoT-enabled ESP32 module and temperature sensor (eg. IC LM35 / DHT22) by interfacing them and interpreting the displayed results on a hyper terminal. 2. They develop an understanding of the open-source Android development platform, MIT App Inventor, by creating a sample app that displays and announces a given message. 3. Learners integrate both functionalities by designing an Android application to display real-time temperature and/or humidity readings on a mobile screen. 	10
6.	<p>Project-Based Learning Activity 6: DIY (Do-It-Yourself) Project</p> <ul style="list-style-type: none"> • Objective: To encourage learners to apply their acquired skills by independently identifying and executing a hands-on project that demonstrates their learning from previous activities. • Outcome: <ol style="list-style-type: none"> 1. Learners conceptualize and select a project that integrates multiple skills gained from prior activities. 2. They design, prototype, and implement the project using appropriate tools, components, and techniques. 3. Learners document their process, including observations, calculations, and inferences, to validate their design and functionality. 4. The completed project is evaluated based on creativity, functionality, and adherence to engineering principles. 	10
Total hours		52



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Reference Books:

- Paul Horowitz and Winfield Hill, "The Art of Electronics" Cambridge University Press, 3rd Edition, 2015.
- Paul Scherz and Simon Monk, "Practical Electronics for Inventors" McGraw Hill Education, 4th Edition, 2016.
- Charles K. Alexander and Matthew N. O. Sadiku, "Fundamentals of Electric Circuits" McGraw Hill Education, 4th Edition, 2016.

Online Resources:

- <https://www.thingiverse.com/>
- <http://www.appinventor.org/book2>
- <https://www.espressif.com/>
- <https://appinventor.mit.edu/>
- <https://randomnerdtutorials.com/>

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