Hardware Fellowship Syllabus:

Project 1: Basic Remote Controlled Car **4 Lectures**

- Simple electronic components
    - Resistors
    - Push button
    - Dip switches
    - Diodes
- Encoder & Decoder
    - Introduction
    - Functions
    - Truth Table
    - HT12E & HT12D ICs
- Wireless Communication
    - Introduction with block diagram
    - Amplitude shift keying (Basic Ideas Only)
        - Introduction
        - Generation of ASK signal
            - Introduction
            - Multiplier using op-amp (product modulator)
        - Detection of ASK signal
            - Introduction
            - Band-pass Filter
            - Rectifier
            - Low-pass Filter
            - Comparator
    - RF 433MHz module
    - Marconi Antenna
- Diode based control logic
    - Working principle
    - Truth table
    - Circuit Diagram
- Power Supply
    - Battery
    - Voltage Regulator
- Relay H-bridge
    - H-bridge
    - Relay switching
- Motors
    - DC motors

    - Brushless DC motors
    - Stepper motors and servo-motors
- PCB design
    - Schematic Design
    - Footprints & component placement
    - Tracks & pads design
    - Printing

Project 2: Remote Controlled Car With Microcontroller **3 Lectures**

- Components
    - Crystal oscillator
    - Capacitor
    - Potentiometer
    - Joystick Module
    - Transistor
        - BJT
        - MOSFET
        - IGBT
- Atmega 328p
    - Pinouts
    - Internal and external clock signals
    - Circuit Layout
    - Pin comparison with Arduino Uno
    - Programming using Arduino IDE
- Wireless communication using NRF24L01+ module
    - NR24L01+ module
    - SPI communication with Atmega 328p
- H-bridge
    - BJT as a switch
    - H-bridge using BJTs
    - Replacing BJTs with power MOSFETs

Extra Projects: **3 Lectures**

- Autonomous line following robot
    - IR sensor
    - Interfacing with Atmega 328p
    - Line detection and following
    - Range sensing
    - Positioning
- Self balancing stick with manual tuned PID controller

    - MPU 6050
    - Open and closed loop control systems (introduction only)
    - Tuning PID manually
- Self balancing stick with reinforcement learning (introduction only)