Course	Topic #	Topic Title
🟩 **Course 1: Introduction to Embedded Systems & IoT**	1	What is an Embedded System?
	2	Real-world Applications of Embedded Systems
	3	Basics of IoT (Internet of Things)
	4	Embedded vs. General-purpose Computing
	5	Key Components: Microcontrollers, Sensors, Actuators
	6	Communication & Connectivity Overview
	7	Embedded Hardware Platforms (Arduino, ESP32, STM32)
	8	Software Tools & IDEs
	9	Power Management Basics
	10	Career Opportunities in Embedded & IoT

🟦 Course 2: Digital Electronics Fundamentals	1	Number Systems (Binary, Hex, Decimal)
	2	Logic Gates & Boolean Algebra
	3	Combinational Circuits
	4	Sequential Circuits
	5	Flip-Flops, Registers & Counters
	6	Microcontroller Pinouts & I/O Basics
	7	Digital Timing & Clock Signals
	8	ADC & DAC Concepts
	9	Interfacing Digital Devices
	10	Troubleshooting Digital Circuits

🟧 Course 3: Microcontrollers & Programming Basics	1	Introduction to Microcontrollers (MCUs)
	2	Common MCU Families (AVR, ARM, PIC)
	3	Development Boards (Arduino, ESP32)
	4	Programming Languages (C, C++, MicroPython)
	5	Setting Up IDEs (Arduino IDE, PlatformIO)
	6	Writing & Uploading First Program (Blink LED)
	7	GPIO: Input/Output Control
	8	Using Timers & Interrupts
	9	Debugging Embedded Code
	10	Memory Management in Microcontrollers

🟨 Course 4: Sensors & Actuators	1	Types of Sensors (Temperature, Light, Pressure, etc.)
	2	Analog vs Digital Sensors
	3	Interfacing Temperature & Humidity Sensors
	4	Motion Sensors (PIR, Accelerometer, Gyro)
	5	Distance Measurement Sensors (Ultrasonic, IR)
	6	Actuators: Motors, Servos, Relays
	7	PWM Control for Actuators
	8	Sensor Calibration & Accuracy
	9	Power Requirements & Protection
	10	Practical Project: Automated Fan with Sensor

🟥 Course 5: Communication Protocols	1	UART Basics
	2	I²C Protocol & Applications
	3	SPI Protocol & Applications
	4	CAN Bus for Automotive
	5	Wireless Protocols Overview (Wi-Fi, Bluetooth, Zigbee)
	6	LoRa & Cellular (NB-IoT, LTE-M)
	7	RS232/RS485 Interfaces
	8	Modbus Communication
	9	Choosing the Right Protocol
	10	Practical Project: Sensor Data Over I²C

🟫 Course 6: Real-Time Operating Systems (RTOS)	1	Introduction to RTOS Concepts
	2	Tasks & Scheduling
	3	Inter-task Communication
	4	Mutexes & Semaphores
	5	Memory Management in RTOS
	6	Using FreeRTOS on ESP32
	7	Prioritizing Tasks for IoT Devices
	8	Debugging RTOS Applications
	9	Power Efficiency in RTOS Systems
	10	Practical Project: Multi-tasking Sensor Hub

🟩 Course 7: IoT Connectivity & Cloud	1	IoT Network Architecture
	2	Wi-Fi & MQTT Basics
	3	HTTP & REST APIs for IoT
	4	Using MQTT Brokers (Mosquitto, HiveMQ)
	5	Cloud Platforms (AWS IoT, Azure IoT, ThingsBoard)
	6	Publishing & Subscribing to Data Streams
	7	Securing IoT Communication (TLS/SSL)
	8	Data Logging to Cloud Databases
	9	Mobile App Integration Basics
	10	Practical Project: IoT Weather Station

🟦 Course 8: Power, Security & Reliability	1	Power Supply Design for Embedded Systems
	2	Battery Management & Low Power Modes
	3	Energy Harvesting Basics
	4	Watchdog Timers & Fault Recovery
	5	Firmware Updates Over-the-Air (OTA)
	6	Secure Boot & Encryption
	7	Hardware Security Modules
	8	Protecting IoT Devices from Attacks
	9	Testing & Certification Standards
	10	Practical Project: Low-power Secure Sensor Node

🟧 Course 9: Edge Computing & AI in IoT	1	Introduction to Edge Computing
	2	Difference Between Edge, Fog & Cloud
	3	Microcontroller-based Machine Learning (TinyML)
	4	Data Preprocessing on Edge Devices
	5	Using TensorFlow Lite for Microcontrollers
	6	Image & Speech Recognition on Low-power Boards
	7	Predictive Maintenance with Edge AI
	8	Bandwidth & Latency Considerations
	9	Real-world Edge AI Examples
	10	Practical Project: Edge-based Anomaly Detection

🟫 **Course 10: Capstone Projects & Career Prep**	1	Project Selection & Planning
	2	Building End-to-End IoT Solutions
	3	Hardware Design & PCB Basics
	4	Integrating Multiple Sensors & Actuators
	5	Cloud Dashboard Visualization
	6	Mobile App or Web Interface for IoT
	7	Documentation & Version Control
	8	Testing & Deployment Strategies
	9	Preparing for Embedded/IoT Certifications
	10	Presenting Capstone Project