SL. NO.	COURSE NAME	TABLE OF CONTENT	Duration (hours)
1	**Introduction to IoT**	Internet of Things and the New Dimension of Connectivity	20 Hours
		IoT from an Embedded Systems Point of View	
		Nanotechnology and Industry 4.0	
		Industrial IoT and Consumer IoT	
		The Characteristics, Applications, and Benefits of IoT	
		Technologies that have Supported IoT Growth	
		THING Architecture	
		Layers of IoT (Architectural View)	
		Sensing/Actuation & Information Processing	
		M2M and IoT	
		IoT Functional Blocks	
		Essential Features of Raspberry Pi & Arduino	
		Standards: National & International Scenario	
2	**Embedded Computing for IoT Systems**	Introduction to Embedded Systems	15 Hours
		ARM Cortex-M4 Processor Architecture Part I	
		ARM Cortex-M4 Processor Architecture Part II	
		Implementation of C Code in Assembly Language	
		Interrupts	
		Low Power Requirements	
3	**Embedded Sense for IoT Systems**	Software Engineering for Embedded Systems	10 Hours
		Concurrency	
		General Purpose Input Output (GPIO)	
		Analog Interfacing	
		Timers	
		Serial Communication	
		DMA: Dynamic Memory Access	
		Programming Techniques for Power efficient computing	
4	**Embedded Linux for IoT Systems**	Introduction to Linux	20 Hours
		Introduction to Operating System	
		Introduction to Kernel	
		Linux commands and File Permissions	
		Customizing Embedded Linux	
		Processes and Signals	
		Threads	

		Single and Multi-Core Systems	
		Process Synchronization	
		Inter-process Communication	
		Pipes and Queues	
		File System	
		Memory Management	
5	**Cloud Computing for IoT Systems**	Introduction to Cloud Computing	15 Hours
		Characteristics of cloud computing	
		Software Virtualization	
		Containerizing applications	
		Virtual Machine Provisioning & Manageability	
		Cloud Deployment models	
		Cloud service models: PaaS, SaaS, IaaS	
		Introduction to IoT Platform	
		Cloud IoT Architecture	
		IoT Cloud Services	
		Identity & Device Management	
		Introduction to Dashboards & Web portals	
		Introduction to Google, AWS & Azure IoT core services	
		Business & Technical considerations for choosing the right IoT Cloud Platform	
6	**Mobile Application Development**	Introduction to Mobile Application Development	30 hours
		Popular Mobile Platforms and their Programming Environment	
		Google's Android OS	
		Architectural overview of Android OS	
		Introduction to Apple's iOS	
		Cross Platform Applications	
		Ionic App Core Building Blocks	
		Ionic Components	
		Web Design Basics	
		Hyper Text Mark-up Language or HTML	
		Basics of Cascaded Style Sheet or CSS	
		Basics of JavaScript	
		Basics of TypeScript	
		REST API Design Principles	

7	**C Programming for IoT**	Introduction to C Programming	15 Hours
		Functions	
		Arrays & Pointers	
		Strings, Structures and Unions	
		Pre-processors, Dynamic Memory Allocation	
		Data Structures and Linked Lists	
		Data Structures and Searching Algorithms	
8	**Python for IoT**	Introduction to Python	10 Hours
		Strings, Lists, Tuples, and Dictionaries	
		Functions, Modules, Files, and Exceptions	
		Oops Concepts	
9	**Communication Models and Protocols for IoT Systems**	Introduction to IoT Protocols	30 Hours
		Introduction to Edge Computing	
		MQTT: Message Queue Telemetry Transport	
		RESTful Design in IoT	
		IoT Protocol Stack & CoAP	
		IoT Application Layer Protocol: CoAP	
		Basics of WebSockets	
		IoT Gateway Design and Characteristics	
		Protocol Bridging HTTP CoAP	
		IoT Protocol Convergence	
10	**Database Management System**	Introduction to DBMS	20 Hours
		DBMS for IoT Systems	
		Databases Embedded in IoT Devices and their DBMS	
		DBMS at the Edge	
		DBMS at the Fog	
		DBMS on the Cloud	
11	**Wireless Sensors Networks for the Internet of Things – Part 1**	Introduction to Networking	10 Hours
		Layered Architecture – OSI Model to TCP/IP Model	
		Network and Internet Protocol	
		Addressing	
		Subnet & Supernet	
		Packet Header Structure	

		TCP - Transmission Control Protocol and UDP – User Datagram Protocol	
		Clustering and Routing	
12	**Wireless Sensors Networks for the Internet of Things – Part 2**	IEEE 802.15.4	10 Hours
		Architecture of ZigBee	
		Application Framework	
		ZigBee Device Object (ZDO)	
		6LoWPAN and Architecture of 6LoWPAN	
		Networking	
		Mobility	
		Application Protocols	
		Hardware Platforms and Software Stacks	
13	**Embedded Systems with Drones**	Introduction to Embedded Systems	20 Hours
		ARM Cortex-M4 Processor Architecture I	
		Interrupts	
		General Purpose Input Output (GPIO)	
		Analog Interfacing	
		Timers	
		Serial Communication	
		Bonus chapter: Programming Techniques for Power-efficient computing	
		Drone Experiments	
		Bonus Labs with STM-Nucleo Kit	
		Online Course	
		Embedded systems for Drones	
14	**Introduction to Electromagnetic Compatibility**	Preamble of EMI & EMC	15 hours
		Sources of EMI	
		EMI-EMC Standards	
		EMI-EMC Measurements-I	
		Designing for EMC	
		EMI Control Techniques-I	
		System Level EMC	
		EMC Checklist/Summary	
		EMI-EMC Test Facilities	

15	**Advanced Aspects of Electromagnetic Compatibility**	Introduction to EMC	20 hours
		EMI Physics	
		EMI-db Measurement	
		EMC Analysis & Prediction	
		EMC References & Problems	
		Understanding the Problem	
		EMC Design Standards and Specifications	
		EMI Transients, ESD, and EFT	
		EMI Filter Design	
		Grounding and Bonding	
		EMC Design Aspects	
		EMC in Automotive Electronics	
		Shielding Design	
16	**Machine Learning**	Python Programming using NumPy, Pandas, Scikit-learn, and Matplotlib	20 hours
		Linear & Logistic Regression, and Least Squared Method	
		Overfitting, Under-fitting, & its Prevention Techniques	
		Regularization and its Techniques	
		Anomalies and Anomaly Detection	
		Natural Language Processing (NLP)	
		Sentence Segmentation, Tokenization, Stemming and Lemmatization	
		Dependency Parsing, POS Tagging and Named Entity Recognition	
		Libraries like spaCy and NLTK with Hands on Example	
		Matrix Factorization Approach	
		Neural Networks, Artificial Neural Networks (ANN), and Convolutional Neural Networks (CNN)	
		Autoencoders, Image Analysis and its Applications	
		ResNet 50 and Residual Mapping	
		K-Means Clustering, Hierarchical Clustering, and Density Based Clustering	
		Dimension Reduction and its Types	
		Statistics in Machine Learning	
		Parametric Tests and Non-Parametric Tests	
		Pearson Correlation Coefficient and Z-Test	
		ANOVA and Spearman's Rank Correlation	
		Hands-on Examples for all of the above	

17	**Building Wireless Community Networks 2.0**	Wireless Networking Standards – IEEE	30 hours
		Radio Physics	
		Practical Planning for Implementing a Wireless Network	
		The Network Layer	
		Unicast, Multicast and Broadcast Addresses	
		Routing, Web Proxies, and IP Tunnelling	
		Network Topologies and Infrastructure	
		IoT and Wireless Networking Protocols	
		ZigBee and Use Cases	
		NFC Categories and Properties	
		Innovations in Wireless Networking	
		Wi-Fi 5 and Wi-Fi 6	
		Radio Device Configuration	
		SSID (Service Set Identifier)	
		Request-to-send (RTS) / Clear-to-send (CTS)	
		Access Control through MAC filtering	
		Encryption and Restricted Access Through Authentication	
		How to Make Wireless Networks Secure	
		Sniffing, Spoofing and Session Hijacking	
		Denial of Service	
		Troubleshooting a Wireless Network	
		Bottom-up, Top-down, and Middle-top/down Troubleshooting	
		Software Tools and Utilities for Troubleshooting	
18	**Introduction to Blockchain**	Introduction to Blockchain	10 Hours
		Cryptography in Blockchain	
		Consensus protocol	
		Bitcoin	
		Ethereum	
		Challenges	
		Application and Use cases	
		Future Outlook	
19	**Introduction to Innovation Management & Intellectual Property**	Introduction to Intellectual Property Rights	5 hours
		Different Forms of IP	
		Patents - Introduction	

		Patentability: Eligibility Criteria	
		Patent Application	
		Patent Registration process	
		Trademarks - Introduction	
		Creating a strong brand name	
		Trademark Registration	
		Trademark: Key concepts	
		Introduction to Copyright Protection	
		Which artistic expressions are protected under Copyright?	
		Key concepts - Copyright (Important Rights of Copyright Owners Authors)	
		Introduction to Industrial Design	
		Registration of Industrial Design	
		IP Protection: Idea Stage to Commercialization	
		Innovation Management	
20	**Innovation Management and Intellectual Property – Advance**	Introduction	10 hours
		General Concepts of Intellectual Property	
		Trademark	
		Patents	
		Copyright	
		Industrial Design	
		Other Forms of IP	
		Innovation Management	
		IP Commercialization	
21	**Prevention of Sexual Harassment**	**(POSH)**	3 hours
	STUDENT AND EMPLOYEE	Introduction to the module	
		Who may file a complaint?	
		What is Sexual Harassment?	
		Types of Sexual Harassment	
		Defining workplace - Where can Sexual Harassment	
		Complaint Mechanism: Conciliation	
		Complaint Mechanism: Inquiry	
		Interim Redressal	
		False Complaint	
		Confidentiality	
		Concluding the module with a quick recap	

		Final Test	
	EXECUTIVE AUTHORITY	Introduction to the online module	
		Defining Executive Authority	
		Responsibilities of the Executive Authority and Higher Educational Institution	
		Supportive measures of the Executive Authority	
		Constituting an Internal Committee (IC), key functions of IC and removal of IC member.	
		Taking action as per recommendation	
		Interim Relief	
		Action and compensation	
		Consequence of non-compliance	
22	**Software Requirements - Part 1**	Software Requirements Fundamentals	2 Hours
		Requirements Process	
		Requirements Elicitation	
		Requirements Analysis	
23	**Software Requirements - Part 2**	Requirements Specification	2 Hours
		Requirements Validation	
		Practical Considerations	
		Software Requirements Tools	
24	**Software Design - Part 1**	General Design Concepts	2 Hours
		The Context Of Software Design	
		The Software Design Process	
		Software Design Principles	
25	**Software Design - Part 2**	Concurrency	3 Hours
		Control and Handling of Events	
		Data Persistence	
		Distribution Of Components	
		Error and Exception Handling and Fault Tolerance	
		Interaction and Presentation	
		Security	
26	**Software Design - Part 3**	Architectural Structures and Viewpoints	3 Hours
		Architectural Styles	
		Design Patterns	

		Architecture Design Decisions	
		Families of Programs and Frameworks	
27	**Software Design - Part 4**	General User Interface Design Principle	3 Hours
		User Interface Design Issues	
		The Design of User Interaction Modalities	
		The Design of Information Presentation	
		User Interface Design Process	
		Localization and Internationalization	
		Metaphors and Conceptual Models	
28	**Software Design - Part 5**	Quality Attributes	3 Hours
		Quality Analysis and Evaluation Techniques	
		Measures	
		Structural Descriptions (Static View)	
		Behavioral Descriptions (Dynamic View)	
29	**Software Design - Part 6**	General Strategies	4 Hours
		Function-Oriented (Structured) Design	
		Object-Oriented Design	
		Data Structure-Centered Design	
		Component-Based Design (CBD)	
		Other Methods	
		Software Design Tools	
30	**Software Construction Part 1**	Minimizing Complexity	2 Hours
		Anticipating Change	
		Constructing for Verification	
		Reuse	
31	**Software Construction Part 2**	Construction in Life Cycle Models	1 Hour
		Construction Planning	
		Construction Measurement	
32	**Software Construction Part 3**	Construction Design	3 Hours
		Construction Languages	
		Coding	
		Construction Testing	
		Construction for Reuse	

		Construction with Reuse	
		Construction Quality	
		Integration	
			1 Hour
33	**Software Construction Part 4**	Construction Technologies	
		Construction Tools	
34	**Software Testing Part 1**	Testing Related Terminology	2 Hours
		Key Issues	
		Relationship of testing to other activities	
		The Target of the Test	
		Objectives of Testing	
35	**Software Testing Part 2**	Input Domain-Based Techniques	3 Hours
		Code-Based Techniques Prerequisites	
		Usage-Based Techniques	
		Selecting and Combining Techniques	
		Evaluation of the Program Under Test	
		Evaluation of the Tests Performed	
36	**Software Testing Part 3**	Practical Considerations	1 Hour
		Test Activities	
		Testing Tool Support and Categories of Tools	
37	**Software Engineering Management Part 1**	Introduction	3 Hours
		Definition and Terminology	
		Modeling Principles	
		Determination and Negotiation of Requirements, Feasibilty Analysis	
		Majority of Maintenance Costs	
		Process Planning	
		Resource Allocation and Risk, Quality, Plan Management	
38	**Software Engineering Management Part 2**	Software Project Enactment	2 Hours
		Review and Evaluation	
		Determining Closure and Closure Activities	
		Software Engineering Measurement	
		Software Engineering Management Tools	

39	**Software Configuration Management - Part 1**	Organizational Context for SCM	2 Hours
		Constraints and Guidance for SCM Process	
		Planning for SCM	
		SCM Plan	
		Surveillance of SCM	
40	**Software Configuration Management - Part 2**	IDing Items to be Controlled	3 Hours
		Software Library	
		Requesting, Evaluation & Approving SW changes	
		Implementing Software Changes	
		Deviation & Waivers	
41	**Software Configuration Management - Part 3**	Software Configuration Status Information	3 Hours
		Software Configuration Status Reporting	
		Software Functional Configuration Audit	
		Software Physical Configuration Audit	
		In-Process Audits of a Software Baseline	
42	**Software Configuration Management - Part 4**	Software Building	2 Hours
		Software Release Management	
		Software Configuration Management Tools	
43	**Software Maintenance Part 1**	Nature of Maintenance	3 Hours
		Need for Maintenance	
		Evolution of Software	
		Categories of Maintenance	
		Technical Issues	
		Management Issues	
		Maintenance Cost Estimation	
		Software Maintenance Measurement	
44	**Software Maintenance Part 2**	Maintenance Processes	3 Hours
		Maintenance Activities	
		Program Comprehension	
		Re-engineering	
		Reverse Engineering	
		Migration	

		Retirement	
		Software Maintenance Tools	
45	**Software Engineering Process Part 1**	Software Engineering Process	2 Hours
		Software Life Cycle Models, Process Adaptation, and Practical Considerations	
		Software Process Assessment and Improvement	
46	**Software Engineering Process Part 2**	Software Process and Product Measurement	2 Hours
		Quality of Measurement Results, Software Information Models	
		Software Process Measurement Techniques	
		Software Engineering Process Tools	
47	**Software Engineering Economics**	Economics Fundamentals	2 Hours
		For-Profit Decision Making	
		Not-For-Profit Decision Making	
		Present Economy	
		Estimation, Risk and Uncertainty	
		Multiple Attributes	
48	**Software Quality**	Software Quality Fundamentals	2 Hours
		Software Quality Management Processes	
		Practical Considerations	
49	**Software Engineering Models and Methods Part 1**	Properties and Expression of Models	3 Hours
		Syntax, Semantics and Pragmatics	
		Preconditions, Postconditions and Invariants	
		Information Modeling	
		Behavioral Modeling	
		Structure Modeling	
50	**Software Engineering Models and Methods Part 2**	Analyzing for Completeness	3 Hours
		Analyzing for Consistency	
		Analyzing for Correctness	
		Traceability	
		Interaction Analysis	
		Heuristic Methods	
		Formal Methods	

		Prototyping Methods	
		Agile Methods	
51	**Professional Practices**	Accreditation Certification and Licensing	1 Hour
		Group Dynamics and Psychology	
		Communication Skills	
52	**Introduction to Cybersecurity**	Overview of Cybersecurity	
		Creating your own Lab Environment	
		Logical Security and types of Threats	
		Cybersecurity Core Concepts	
		Various processes for Cybersecurity	
		Complementary technologies and Tools for Cybersecurity	
		Introduction to Penetration Testing (Pen Testing)	
		Cybersecurity Frameworks	
		Network Security	
		Mobile Security	
53	**Public Key Infrastructure**	Cyber Hygiene with Law	25 Hours
		Cryptography and PKI Algorithm	
		AES and PKI Algorithms	
		Digital Signatures	
		PKCS standards	
		OSCP	
		SSL	
		eSign	
		Authentication Protocols	
54	**Concepts of Operating Systems and Administration**	Linux Fundamentals and Basic commands	40 Hours
		Linux File System and Permissions	
		File System Management and Partitioning	
		Disk Quota Management	
		Linux User Administration and Package Management	
		Linux Services Management	
		Domain Name System	
		Web Server	
		Linux Security	
		Fundamentals of Windows Operating System	
		Windows Active Directory	

		Windows File System management	
		Windows Security	
55	**Ethical Hacking**	Introduction to Ethical Hacking	40 Hours
		First Phase of Ethical Hacking - Reconnaissance	
		Second Phase of Ethical Hacking - Scanning and Enumeration	
		Network Sniffing	
		Third Phase - Gaining Access	
		Exploitation in LAN Environment	
		Password Cracking	
		Denial of Service Attack	
		WiFi Exploitation	
		Web Application Security	
		SQL Injection Attack	
56	**4G**	LTE Architecture and Evolved Packet System Architecture	8 Hours
		E-UTRAN Architecture and EPC Architecture & VOLTE	
		LTE E-UTRAN and E-UTRA	
		LTE Layer 1 (Physical Layer)	
		LTE Layer 2 (MAC, RLC, PDCP)	
		LTE Layer 3 (RRC Layer)	
57	**5G**	The vision of 5G	8 Hours
		KPI	
		5G standardization road	
		5G NR requirements	
		The spectrum of 5G	
		Synchronization signals	
		Comparison of 4G and 5G	
58	**Fundamentals Of Cyber Security**	Common Terms used in Cyber Security.	4 Hours
		Defensive and offensive Security*	
		Physical and Logical Security.	
		Administrative Security.	
		OSI Layer Security*	
		Defense in Depth.	

59	**Enterprise Cyber Security Organisation**	Cyber Security Structure in an Organisation.	3 Hours
		Security Team Composition and roles.	
		Security Policies, Procedures, and Guidelines.	
		Typical day in the life of Security Analyst	
		OT and IT Security Practices.	
			5 Hours
60	**Network Security**	Networking Essentials.	
		Networking Devices – Hub, Switches, Router, Proxy, and Load Balancer.	
		Network Security Devices – Firewall, UTM, IDS, IPS, SIEM, DDoS. *	
		Ports (DNS, DHCP, SMTP, SNMP, Telnet), Port Scanner	
		Network Security Architecture*	
		Network Security Best Practices.	
			4 Hours
61	**Application Security**	Software Development Life Cycle.	
		Using Commercial off the Shelf (COTS) Software.	
		Change and Release Management.	
		DevOps and DevSecOps.	
		Common Application Security Vulnerabilities- OWASP	
62	**Mobile Device and Wi-Fi Security**	Mobile Device Security.	4 Hours
		Native vs Hybrid vs PWA.	
		Cyber Risks in Wi-fi and Mobile Environments.	
		Mobile Device Management (MDM).	
		Secure Wi-fi Configuration. *	
63	**Data Security**	Data Life Cycle.	3 Hours
		CIA Triad.	
		Identify and Access Management.	
		Data Loss Prevention (DLP)	
		Meta Data Analysis.	
		Phishing Attacks and Analysis.	
64	**Malware Attack and Prevention**	Malware and its various types	4 Hours
		Ransomware and Prevention.	
		Advanced Persistent Threats (APT)	
		Attacks, Exploits and Preventative Measures.	
		Operating System (OS) Security – Windows and Linux.	

		Overview of basic Windows and Linux Commands.	
		Operating System Hardening.	
		Honey Pots.	
65	**Security Review and Testing**	Penetration Testing Overview	5 Hours
		Reconnaissance – Active and Passive.	
		Vulnerability Assessment and CVSS Overview.	
		Penetration Testing Networks.	
		Penetration Testing Web Applications.	
		MITRE Attack Framework Overview.	
		Reverse Engineering	
			4 Hours
66	**Cyber Security Management**	Overview of IT Risk Assessment	
		Cyber Security Incident Management Process.	
		Incident Response and Root Cause Analysis. *	
		Digital Forensics. *	
		Cyber Law Ethics and Conflict Resolution.	
67	**Emerging Technologies**	Open Source and Virtual Computing.	4 Hours
		Cloud Computing.	
		Internet of Things (IOT). *	
		Robotic Process Automation (RPA). *	
		Artificial Intelligence and machine Learning (ML).	
68	**Algorithms & Complexity**	Overview of Algorithms	5 Hours
		Attributes of Algorithms	
		Algorithmic Analysis	
		Sorting Algorithms	
		Shuffling and Searching Algorithms	
		Traversal Algorithms	
		Algorithmic Design Strategies	
		Algorithmic Analysis Strategies	
69	**Data Structure**	Data Structure Overview	15 hours
		Types of Data Structure	
		Operations on Data Structures	
		Data structures and their applications	
		Types of data structures	
		Linked lists and their types	

		Stacks, queues and heaps	
		Process to build a heap	
		Implementation : Priority queues using heaps	
		Hash tables and trees	
		Performing traversing in binary trees	
		Features of a red-black tree	
		Features of a trie tree	
70	**Programming Fundamentals**	Programming Language Overview	15 Hours
		Syntax and Semantics of Programming Languages	
		Low-Level Programming Languages	
		High-Level Programming Languages	
		Declarative vs. Imperative Programming Languages	
		Logic Programming	
		Functional Programming	
		Object Oriented Languages	
		Multi-paradigm Languages	
		Effective Programming	
		Domain specific case-studies	
		Arrays & Lists	
		Programming Basics	
		Unicode and Integers	
		Little Endian & Big Endian Schemes	
		Iteration or Recursion	
		Object oriented programming	
		Polymorphism	
71	**Secure Software Development and Maintenance**	Security Engineering and Security Principles	15 Hours
		Security Attacks and Malware	
		Secure Software Engineering and Maintenance	
		Web and Network Security	
		Firewall	
		Secure Coding	
		CERT Guidelines	
		Language-neutral Coding Guidelines	
		Assignments	

72	**Compilers and interpreters**	Implementing Compilers and Interpreters	20 Hours
		Case Study: Java Execution	
		Structure of a Java Compiler	
		Implementing Lexical Analyzer(s)	
		Tokenization for Programming Tasks	
		Implementing Parser(s)	
		Parsing & Semantic Analysis	
		Types of Parsing Algorithms	
		Binary Expression Trees	
		Case Study: YACC Parser Generator	
		Case Study: Lex Code - Calculator	
		Case Study: YACC Code - Calculator	
		Case Study: Trying out - Calculator	
		Intermediate Code Generation	
		Implementing Interpreter(s)	
		REPL (Read-Eval-Print-Loop)	
		Case Study: Python Interpreter	
		Stack Frames for Function Calls	
		Implementing a Bytecode Interpreter	
		Creating Makefiles	
		Version Control System	
		RCS Tool	
73	**OT Security 1**	Introduction to Operational Technology (OT) Security	20 Hours
		OT Attack Surface, Threats, and Prevention	
		Convergence of Operational Technology (OT) and Information Technology (IT)	
		Critical Infrastructure Protection (CIP)	
74	**OT Security 2**	OT Network & Security – Concepts & Case Studies	20 Hours
		Industrial Internet of Things (IIoT) Security	
		Risk Assessment and Testing for OT Security	
		Cybersecurity for connected systems: Case Studies	
75	**High Performance Computing**	HPC Cluster	10 Hours
		Parallel Programming Modules	
		Advanced Programming	
		Power Management & Petascale Exascale computation in HPC	

76	**Wearable Technologies**	The Dawn of Wearable Technology: Why wearables? Past, Present, and Future	10 Hours
		Sensors and Actuators: The Building Blocks	
		Powering the Future: Energy Sources and Power Management	
		Communication technologies (Bluetooth, BLE, Wi-Fi, NFC, LoRA)	
		Data Analytics and AI in Wearables	
		Design Principles of Wearable Technology	
		Case Studies in Wearable Tech	
		Standards, Privacy, Security, and Ethical Considerations	
		Emerging Trends and Future Directions	