Prerequisite/objectives/learning outcomes as provided by course on SWAYAM website.
Number of Credits: 4

SEMESTER II

Course Code: ELC 201
Title of the Course: EMBEDDED SYSTEMS DESIGNS & IoT
Number of Credits: 4

Prerequisites for the course:	Should have studied microprocessor and C programming at graduate level	
Objective:	• Architectures of Microcontroller and its programming with Interfacing various Interfaces is discussed in depth in this paper. • In this course students are going to learn how to develop apps for Android phone using SDK. • To Understand the Architectural Overview of IoT • To Understand the IoT Reference Architecture and Real-world Design Constraints • To Understand the various IoT Protocols (Data link, Network, Transport, Session, Service)	.
Content:	**Architectures: Embedded system , Computer Architecture,** RISC/CISC and Harvard/Princeton Architectures, Introduction to 8-bit Micro controllers , ARM : Introduction to 32/64-bit Processors, Latest ARM ,ARM Architecture & Organization, ARM/THUMB, ARM/THUMB Instruction Set, ARM Exception Handling,Timers/Counters, UART, SPI, PWM, WDT, Input Capture, Output Compare Modes, I2C .	10
	Interfacing: LED, Switches, ADC, DAC, LCD	2
	Programming : ARM programming in Assembly and C (GNU Tools),	7
	Introduction to Android & app development	3
	IoT ARCHITECTURE AND PROTOCOLS: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M .	8
	Introduction IoT Big Data Analytics	2
	IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4,	5

	IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP	
	TRANSPORT & SESSION LAYER PROTOCOLS Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT	**6**
	SERVICE LAYER PROTOCOLS & SECURITY Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols– MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.	**5**
Total		**48**
Pedagogy:	lectures/ tutorials/assignments/self-study/Flipped classroom	
References/Readings	1. Jivan Parab etal., Exploring C for microcontroller (Springer 2007) 2. Lipovski G. J. Single and multiple Chip Microcontroller interfacing. Prentice Hall, USA 1998. 3. Beginning Android 4 Application Development 4. Professional Android 4 Application Development Learning Android Game Programming : A Hands-On Guide to Building Your First Android Game 1st Edition 5 .Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle, "From Machine-to-Machine to theInternet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. 8. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet ofThings", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer 9. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.	
Learning Outcomes	• Students will be able to develop their own embedded platform using ARM • They will be able to design android application for mobiles • understand where the **IoT**concept fits and possible future trends; understand the various network protocols used in Application	

Course Code: ELD201   **Title of the Course:** OPTICAL COMMUNICATION SYSTEMS