Honours*in Internet of Things

Year & Semester	Course Code	Course	Teaching Scheme Hours/Week			Examination Scheme and Marks						Credit Scheme		
			L	T	P	MSE-1	MSE-II	CIE	TA	ESE/Oral	Total Marks	L/T	P	Total Credit
SY IV	ECED901	Embedded Internet Of Things	04	--	--	15	15	10	10	50	100	04	--	04
	ECED971	Embedded Internet of Things Laboratory	--	--	02	--	--	--	25	--	25	--	01	01
		Total	04	-	02	125					125	04	01	05
														Total Credits=05
TY V	ECED902	Communication Protocols for IoT	04	--	--	15	15	10	10	50	100	04	--	04
		Total	04	-	-	100					100	04	--	04
														Total Credits =04
TY VI	ECED903	Sensors Network & Internet of Things	04	--	--	15	15	10	10	50	100	04	--	04
	ECED972	Sensors Network & Internet of Things Laboratory	--	--	02	--	--	--	25	--	25	--	01	01
		Total	04	--	02	125					125	04	01	05
														Total Credits=05
Final B.Tech VII	ECED904	Privacy and Security in IoT	04	--	--	15	15	10	10	50	100	04	--	04
		Total	04	--	--	100					100	04	--	04
														Total Credits=04
Final B.Tech. VIII	ECED973	Mini Project	--	--	04	--	--	--	25	25	50	--	02	02
		Total	--	--	04	--	--	--	25	25	50	--	02	02
														Total Credits=02

Total Credit for Semester
IV+V+VI+VII+VIII= 20

L-Lecture, T-Tutorial, P- Practical, MSE- Mid Semester Exam, CIE-Continuous Internal Evaluation, TA-Teacher Assessment, ESE-End Semester Examination

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Department of Electronics and Computer Engineering

Syllabus of SY B.Tech.(Honours*in Internet of Things)Semester-IV

Course Code:ECED901 Course: Embedded Internet of Things **Teaching Scheme:** Theory:4Hrs/week	Credits:4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation:10 Marks Teacher Assessment: 10Marks EndSemesterExamination:50Marks End Semester Examination (Duration):2Hrs

Prerequisite		Basic Electronics, Basic Programming Language
Objectives	:	• To learn and understand the basics of embedded systems. • To design embedded systems applications. • To understand Internet of Things and its usefulness for society.
Unit-I	:	**Embedded System Overview** Embedded Systems: Architecture & Characteristics of ES, Types of Embedded systems, Examples of Embedded Systems. Embedded System On Chip (SOC). Components of ES: Hardware and software. Hardware components of ES: Power supply: types, characteristics, selection criteria, Processing Unit, Input devices, Output Devices. (8 Hrs)
Unit-II		**Introduction to ES System Software** Operating Systems Concepts, Real time operating systems, and, Task Scheduling, Different OS tasks, Introduction to Real-Time Operating Systems, characteristics, selection criteria, bootloader: U-boot. (8 Hrs)
Unit-III	:	**Introduction to Industry 4.0** Need of Industry 4.0, Industrial Revolution, Design Principles of Industry 4.0 , Characteristics of Industry 4.0, Issues and Challenges of Industry 4.0 (8 Hrs)
Unit-IV	:	**Introduction to IoT** Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies, Data, Physical design of IoT, IoT enabling technologies, IoT Issues and Challenges- Planning, Costs and Quality ,Security and Privacy, Risks. (8 Hrs)
Unit-V	:	**Development boards for IoT** Development boards: Types of boards, Arduino, Raspberry pi, ESP8266, ESP 32, selection criteria, Interfacing of sensors, Bluetooth, LoRA module with development boards (8 Hrs)

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Unit-VI	:	**Embedded System - Application Development** Architecture, Design, Components, Coding, Testing and Deployment. Case Studies: Object detection, Traffic signal, Digital clock, Pulse Oxymeter, Robotics arm movement, Fire alarm, Automated disinfection tent, Tyre pressure monitoring system and smart meter. (8 Hrs)
Referenceb ooks/ Textbooks	:	1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0:0996025510, 13: 978-0996025515. 2. Lyla B. Das, "Embedded Systems: An Integrated Approach" Pearson , ISBN: 9332511675, 9789332511675 3. Sriram V. Iyer, Pankaj Gupta, "Embedded Real-time Systems Programming", Tata McGraw-Hill, ISBN: 13: 9780070482845 4. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017 5. Raj Kamal, "Embedded Systems: Architecture, programming and Design", 2nd Edition, McGrawHill, ISBN: 13: 9780070151253 6. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3. 7. Vijay Madisetti, Arshdeep Bahga, —Internet of Things (A Hands-on Approach), Universities Press, 2015.

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Syllabus of SY B.Tech.(Honours*in Internet of Things)Semester-IV

Course Code: ECED971 Course : Laboratory Embedded Internet of Things **Teaching Scheme:** Practical:2Hrs/week	Credits:0-0-1 Teacher Assessment: 25Marks

Prerequisite		Basic Electronics, Basic Programming Language
Objectives	:	• Exploring the fundamentals and functionality of various embedded board platforms. • To design and implement interconnection and integration of sensors to embedded board platform • To design and implement application of IoT using various sensors
Laboratory Experiments	:	1. Write an application to read temperature from the environment. If temperature crosses threshold value then it notifies with buzzer. 2. Understand the connection and configuration of GPIO and its use in programming. Write an application of the use of push switch and LEDs. 3. Create a simple web interface for NodeMCU 1.0 to control the connected LEDs remotely through the interface. 4. Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi. 5. Interface IR sensor to Raspberry Pi/ Arduino. Write a program to detect obstacle using IR sensor and notify it using LED. 6. Write an application using Raspberry Pi/Arduino for streetlight control system. System consists of smart street lights that have external light sensing that automatically turns on at desired intensity based on amount of lighting needed. 7. Write an application using Raspberry Pi/Arduino for smart health monitoring system which records heart beat rate and temperature and also sends SMS alerts if readings are beyond critical values. 8. Understanding and connectivity of Raspberry-Pi /Arduino board with a Zigbee module. Write a network application for communication between two devices using Zigbee to on and off remote led. 9. Understanding and connectivity of Raspberry-Pi /Arduino board with a LoRA module. Write a network application for communication between two devices using LoRA module to on and off remote water pump. 10. Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board

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Referenceb ooks/ Textbooks	:	1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0:0996025510, 13: 978-0996025515. 2. Lyla B. Das, "Embedded Systems: An Integrated Approach" Pearson , ISBN: 9332511675, 9789332511675 3. Sriram V. Iyer, Pankaj Gupta, "Embedded Real-time Systems Programming", Tata McGraw-Hill, ISBN: 13: 9780070482845 4. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017 5. Raj Kamal, "Embedded Systems: Architecture, programming and Design", 2nd Edition, McGrawHill, ISBN: 13: 9780070151253 6. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3. 7. Vijay Madisetti, Arshdeep Bahga, Internet of Things (A Hands-on Approach), Universities Press, 2015.

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Syllabus of TY B.Tech.(Honours*in Internet of Things) Semester-V

CourseCode:ECED902 Course: Communication Protocols for IoT **Teaching Scheme:** Theory:4Hrs/week	Credits:4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation:10 Marks Teacher Assessment: 10Marks End SemesterExamination:50Marks End Semester Examination (Duration):2Hrs

Prerequisite		None
Objectives	:	The purpose of this course is to impart knowledge on IoT and various protocols study their implementations.
Unit-I	:	**Introduction** IoT architecture outline, standards, IoT Technology fundamentals, devices and gateways, local and wide area networking, data management, business processes in IoT, Everything as a Service (XaaS),M2MandIoTAnalytics (8 Hrs)
Unit-II		**IoT Reference Architecture** Introduction, functional view, information view, deployment and operational view, other relevant architectural views. real-world design constraints, introduction, technical design constraints. (8 Hrs)
Unit-III	:	**IoT Data Link Layer & Network Layer Protocols** PHY/MAC Layer(3GPPMTC,IEEE802.11,IEEE802.15),Wireless HART,Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7,Network Layer,IPv4,IPv6,6LoWPAN, DHCP,ICMP,RPL,CORPL,CARP (8 Hrs)
Unit-IV	:	**IoT Transport Layer Protocols** Transport Layer-TCP,MPTCP,UDP,DCCP,SCTP,TLS,DTLS (8 Hrs)
Unit-V	:	**IoT Session Layer Protocols** Session Layer-HTTP, CoAP, XMPP,AMQP,MQTT (8 Hrs)

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Unit-VI	:	**IoT Service Layer Protocols &Security Protocols** Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC802.15.4,6LoWPAN,RPL,ApplicationLayer (8 Hrs)
Reference books/Text books	:	1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, WillyPublications,2016 2. JanHoller,VlasiosTsiatsis,CatherineMulligan,StefanAvesand,Stamatis Karnouskos,DavidBoyle,"FromMachine-to-MachinetotheInternetofThings: Introduction to a New Age of Intelligence",1stEdition,AcademicPress,2015 3. BerndScholz-Reiter,FlorianMichahelles,"ArchitectingtheInternetofThings",ISBN978-3-64219156-5e-ISBN978-3-642-19157-2, Springer,2016 4. N.Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers,2014.

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Syllabus of TY B.Tech.(Honours*in Internet of Things)Semester-VI

CourseCode:ECED903 Course: Sensor networks &IoT **Teaching Scheme:** Theory:4Hrs/week	Credits:4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation:10 Marks Teacher Assessment: 10Marks End SemesterExamination:50Marks End Semester Examination(Duration):2Hrs

Prerequisite		None
Objectives	:	To impart the knowledge and technical skills in designing Sensor networks and IoT
Unit-I	:	**Introduction** Introduction and overview of sensor network architecture, sensor network types and comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details, application of sensor networks in smart transportation, smart cities, smart living, smartenergy, smart health, and smart learning. (8 Hrs)
Unit-II		**Sensor Network Systems** Cyber Physical Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security ,Real-World Design Constraints- Introduction, Technical Design constraints, hardware, Data representation andvisualization, Interaction and remote control. (8 Hrs)
Unit-III	:	**IOT Physical Devices & Endpoints** IOT architecture, IOT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IOT, Everything as a Service (XaaS), Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time

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		Synchronization, Positioning and Localization, Medium Access Control, Topology, Routing: Transport Protocols, Network Security. (8 Hrs)
Unit-IV	:	**Industrial Automation& IOT** Industrial Automation-Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation (8 Hrs)
Unit-V	:	**Case Study – IOT Implementations** Case study: Smart Grid and IoT, Commercial building automation using IoT, Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT. (8 Hrs)
Unit-VI	:	**IOT Projects** Creating the sensor project , Preparing Raspberry Pi/ ARM Cortex ,Clayster libraries Hardware-Interacting with the hardware ,Interfacing the hardware, Internal representation of sensor values ,Persisting data ,external representation of sensor values, exporting sensor data, creating the actuator project, hardware ,interfacing the hardware ,creating a controller ,representing sensor values, parsing sensor data ,calculating control states ,creating a camera ,Hardware -Accessing the serial port on RaspberryPi / ARM Cortex, interfacing the hardware ,creating persistent default settings, adding configurable properties, Persisting the settings - Working with the current settings -Initializing the camera (8 Hrs)
Reference books/ Textbooks	:	1. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication 2. Internet of Things: A Hands-On Approach Paperback – 2015, by Arshdeep Bahga, Vijay Madisetti 3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014 4. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

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5. Editors Ovidiu Vermesan Peter Friess,'Internet of Things – From Research and Innovation to Market
6. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.
7. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David , Salgueiro Gonzalo , Grossetete Patrick , Barton Rob

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Syllabus of TY B.Tech.(Honours*in Internet of Things)Semester-VI

CourseCode:ECED972 Course: Laboratory Sensor networks &IoT **Teaching Scheme:** Practical:2Hrs/week	Credits:0-0-1 Teacher Assessment: 25Marks

Prerequisite		Basic Electronics, Basic Programming Language
Objectives	:	To impart the knowledge and technical skills in designing Sensor networks and IoT
Laboratory Experiments	:	1. Node MCU/ESP 32 - Temperature Sensor Interfacing (LM35) – Bluetooth Interfacing(HC05)-Motor driver Interfacing(L298)-LCD Interfacing (HD44780) 2. Implementation of IoT using BLYNK/CAYENNE—Installation and Activation - Blinking an LED -Reading Analog Voltage - LCD Interfacing(HD44780)-Project 3. Implementation of IoT using Google Assistant–Arest server-Creating own server – Project 4. Implementation of IoT using Raspberry Pi & Python Programming: -LCD Interfacing(HD44780)-Motor driver Interfacing(L298)–Camera interface

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Reference books/ Textbooks	:	1. Mandler,B.,Barja,J.,MitreCampista,M.E.,Cagáová,D.,Chaouchi,H.,Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L.,Internet of Things. IoT Infrastructures, Springer International Publication 2. Internet of Things: A Hands-On Approach Paperback – 2015, by Arshdeep Bahga ,Vijay Madisetti 3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David,Salgueiro Gonzalo,Grossetete Patrick, Barton Rob

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Syllabus of Final Year B.Tech.(Honours*in Internet of Things)Semester-VII

Course Code:ECED904	Credits:4-0-0
Course: Privacy and Security in IoT	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination -II:15Marks
Theory:4Hrs/week	Teacher Assessment: 10 Marks
	Continuous Internal Evaluation:10 Marks
	End Semester Examination:50Marks
	End Semester Examination (Duration):2Hrs

Prerequisite		None
Objectives	:	• To understand the Security requirements in IoT. • To understand the cryptographic fundamentals for IoT. • To introduce the various types Trust models and Cloud Security.
Unit-I	:	**Introduction** Security requirements in IoT Architecture, security in enabling technologies, Security concerns in IoT applications, Security architecture in the Internet of Things. (8 Hrs)
Unit-II		**Securing the Internet of Things** Insufficient Authentication/Authorization, insecure access control ,threats to access control, privacy, and availability, attacks specific to IoT, vulnerabilities ,secrecy and secret-key capacity. Authentication/Authorization for smart devices, transport encryption, Attack and Fault Trees. (8 Hrs)
Unit-III	:	**Cryptographic fundamentals for IoT** Cryptographic primitives and its role in IoT. Encryption and Decryption, Hashes Digital Signatures, key management, cryptographic algorithms. Random number generation, Cipher suite (8 Hrs)

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Unit-IV	:	**Identity & Access Management Solutions for IoT** Identity lifecycle, authentication credentials, authentication protocols, IoT IAM infrastructure, Authorization with Publish / Subscribe schemes. (8 Hrs)
Unit-V	:	**Privacy Preservation And Trust Models for IoT** Lightweight and robust schemes for Privacy protection, Trust and Trust models for IoT. Authentication protocols. (8 Hrs)
Unit-VI	:	**Cloud Security for IoT** Cloud services and IoT ,offerings related to IoT from cloud service providers , Cloud IoT security controls, An enterprise IoT cloud security architecture, new directions in cloud enabled IoT computing. (8 Hrs)
Reference books/ Textbooks	:	Practical Internet of Things Security (Kindle Edition) by Brian Russell ,Drew Van Duren Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations-by Fei Hu.

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Syllabus of Final Year B.Tech.(Honours*in Internet of Things)Semester-VIII

CourseCode:ECED973 Course: Mini Project **Teaching Scheme:** Practical:4Hrs/week	Credits:0-0-2 Teacher Assessment:25 Marks Practical:25Marks
Prerequisite	Basic Electronics, Basic Programming Language

To carry out a mini project and simple prototype in the area of interest based on the knowledge gained in Internet of Things from undergraduate.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below.

Review#	Requirement	Mark Weightage	
		Internal	External
0	Area/Title selection	-	-
1	Literature review/Proposal for the Project	10%	-
2	Mathematical modelling/Circuit Design	20%	-
3	Final simulation/Hardware presentation	20%	-
End Semester Exam	Final Viva-Voce and project demonstration	-	50%

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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Note:

1. No additional fees will be charged for students opting for Honours/ Minor Degree
2. All the courses in the Honours/ Minor will be conducted in offline mode.
3. Re-examination is not applicable in Honours and Minor Scheme. Student failing in any of the Minor or Honours courses,at any stage will be discontinued from the Scheme.
4. Examination Scheme and Passing rules will be as per the academic rules and regulations of B. Tech.

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