

**DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

**COURSE PLAN – PART I**

<b>Course Title</b>	Smart and Wireless Instrumentation		
<b>Course Code</b>	ICPE33	<b>No. of Credits</b>	3
<b>Course Code of Pre-requisite subject(s)</b>	ICPC20- Microprocessors and Microcontrollers, ICPC23 -Principles of Communication Systems		
<b>Session</b>	July 2018	<b>Section (if, applicable)</b>	A and B
<b>Name of Faculty</b>	Ms. K. Lakshmi	<b>Department</b>	ICE
<b>Email</b>	<a href="mailto:lakshmik@nitt.edu">lakshmik@nitt.edu</a>	<b>Mobile No.</b>	9940934251
<b>Name of Course Coordinator(s) (if, applicable)</b>	Not Applicable		
<b>Course Type</b>	<input type="checkbox"/> Core course <input checked="" type="checkbox"/> Elective course		

**Syllabus (approved in BoS)**

Sensor Classification-Thermal sensors-Humidity sensors-Capacitive Sensors-Planar Inter digital Sensors-Planar Electromagnetic Sensors-Light Sensing Technology-Moisture Sensing Technology-Carbon Dioxide (CO<sub>2</sub>) sensing technology-Sensors Parameters -Frequency of Wireless communication-Development of Wireless Sensor Network based Project-Wireless sensor based on Microcontroller and communication device-Zigbee Communication device. Power sources- Energy Harvesting –Solar and Lead acid batteries-RF Energy /Harvesting-Energy Harvesting from vibration-Thermal Energy Harvesting-Energy Management Techniques-Calculation for Battery Selection Tedes IEEE 1412- Brief description of API mode data transmission-Testing the communication between coordinator and remote XBee- Design and development of graphical user interface for receiving sensor data using C++; A brief review of signal processing techniques for structural health monitoring. WSN based physiological parameters monitoring system- Intelligent sensing system for emotion recognition-WSN based smart power monitoring system.

**COURSE OBJECTIVES**

To provide the adequate knowledge on smart instrumentation and wireless networks

**COURSE OUTCOMES (CO)**

<b>Course Outcomes</b>	<b>Aligned Programme Outcomes (PO)</b>
The students will be able to 1. Design self-diagnosing instrumentation system. 2. Understand the issues in power efficient systems. 3. Design wireless instrumentation systems for the given requirement.	1, 2, 3, 4, 5, 6, 9, 12



**COURSE PLAN – PART II****COURSE OVERVIEW**

This course provides an overview of wireless sensors that are applicable in Industrial Instrumentation and Control. It also gives the basic principles of wireless communication, Zigbee devices and fundamentals of developing and implementing wireless sensor networks for various applications.

**COURSE TEACHING AND LEARNING ACTIVITIES**

S.No.	Week	Topic	Mode of Delivery
1	I	Introduction	C & T
2	I	Sensor Classification- Thermal sensors	C & T
3	I	Thermal sensors-Humidity sensors-	C & T
4	II	Humidity sensors	C & T
5	II	Capacitive Sensors-Planar Inter digital Sensors-Planar Electromagnetic Sensors-Light Sensing Technology	C & T
6	II	Moisture Sensing Technology-Carbon Dioxide (CO <sub>2</sub> ) sensing technology	C & T
7	III	Sensors Parameters	C & T
8	III	Fundamentals of wireless communication	C & T
9	IV	Interfacing of sensors and signal conditioning- Bias, Attenuation, Amplification etc..	C & T
10	IV	Signal conditioning- Potential dividers, Filters, Buffers and various OP-AMP circuits	C & T
11	IV	Frequency of Wireless communication- Development of Wireless Sensor Network based Project	C & T
12	V	Wireless sensor based on Microcontroller and communication device-Zigbee Communication device	C & T
13	V	Power sources- Energy Harvesting	C & T
14	V	Management Techniques-Calculation for Battery Selection	C & T
15	VII	Solar and Lead acid batteries	C & T
16	VII	RF Energy /Harvesting	C & T



17	VII	Energy Harvesting from vibration- Thermal Energy Harvesting-Energy	C & T
18	VIII	Tedes IEEE 1412- Brief description of API mode data transmission-	PPT
19	VIII	Testing the communication between coordinator and remote XBee-	PPT
20	VIII	Design and development of graphical user interface for receiving sensor data using C++	PPT
21	XI	A brief review of signal processing techniques for structural health monitoring.	PPT
22	XI	WSN based physiological parameters monitoring system- -	PPT
23	XI	Intelligent sensing system for emotion recognition and WSN based smart power monitoring system.	PPT

#### COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week	Duration	% Weightage
1	CT I	V	1 hour	20
2	CT II	VIII	1 hour	20
3	Assignment and Seminar	---	---	10
4	Compensation Assessment	XIII	1 hour	20
5	End semester	XIV	2.30 hours	50

#### ESSENTIAL READINGS : Textbooks and reference books

##### Text Books:

1. Subhas Chandra Mukhopadhyay, "Smart Sensors, Measurement and Instrumentation", Springer Heidelberg, New York, Dordrecht London, 2013.
2. Halit Eren, "Wireless Sensors and Instruments: Networks, Design and Applications", CRC Press, Taylor and Francis Group, 2006.

##### References:

1. Uvais Qidwai, Smart Instrumentation: A data flow approach to Interfacing", Chapman & Hall; 1st Edn, December 2013.

#### COURSE EXIT SURVEY

- Direct feedback from the students.
- Students performance in test and their presentation will be used to assess the understanding level.



## COURSE POLICY

- 75% of attendance is must inclusive of on duty on any grounds. However 5% of relaxation can be considered on medical grounds. Students those who got below 75% have to Redo the course.
- Relative grading will be followed. The passing minimum for the course will be either class maximum/ 3 or class average/ 2 whichever is lower.
- Students who absent for any CT (due to medical/ OD and other genuine reasons) will be given a compensation assessment.
- Students who fail in End Semester Examination will have to write Reassessment and those who fail to clear the Reassement have to do Formative assessment for this course.
- The Assessment date and time will be fixed by the faculty in consultation with class representative as per the evaluation schedule.

## MODE OF CORRESPONDENCE (email/ phone etc)

[lakshmik@nitt.edu](mailto:lakshmik@nitt.edu)

## FOR APPROVAL

Course Faculty *K. Lakshmi*

(K. LAKSHMI)

CC-Chairperson *V. Sridevi*

(V SRIDEVI)

HOD *B. V. Ramesh*

*20/8/18*

