# Smart and Wireless Instrumentation

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| **Course Code** | 23EC4601C | **Year** | III | **Semester** | II |
| **Course Category** | PE–II | **Branch** | ECE | **Course Type** | Theory |
| **Credits** | 3 | **L-T-P** | 3-0-0 | **Pre requisites** | Digital Communications |
| **Continuous Internal Evaluation** | 30 | **Semester End Evaluation** | 70 | **Total Marks** | 100 |

| **Course Outcomes** | | |
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| Upon successful completion of the course, the student will be able to | | BL |
| **CO1** | Analyze Smart and Wireless Instrumentation with respect to various performance parameters | L4 |
| **CO2** | Design and develop Applications using WSN (Wireless sensor Network). | L4 |
| **CO3** | Demonstration of various Node architectures | L2 |
| **CO4** | Demonstration of Fundamentals of wireless digital communication | L2 |
| **CO5** | Analyze the power sources, Demonstrate an ability to design strategies as per needs and specifications | L4 |

| **Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of Correlations ( 3:High, 2:Medium, 1:Low )** | | | | | | | | | | | | | |
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| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | 3 | 3 | | | | 3 | | | 3 | | | 2 | |
| **CO2** | 3 | 3 | | | | 3 | | | 3 | | | 2 | |
| **CO3** | 2 | | | | | 3 | | | 3 | | | 2 | |
| **CO4** | 2 | | | | | 3 | | | 3 | | | 2 | |
| **CO5** | 3 | 3 | | | | 3 | | | 3 | | | 2 | |
| Avg | 3 | 3 | | | | 3 | | | 3 | | | 2 | |

| **Syllabus** | | |
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| **Unit No.** | **Contents** | **Mapped CO** |
| 1 | **Introduction:** Sensing and Sensors, Sensor Classifications, Wireless Sensor Networks, History of Wireless Sensor networks (WSN), Communication in a WSN, important design constraints of a WSN: Energy, Self Management, Wireless Networking, Decentralized Management, Design Constraints, Security . | CO1, CO2 |
| 2 | **Node architecture:** The sensing subsystem: Analog to Digital converter, The processor subsystem: Architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate array (FPGA), comparison, Communication interfaces: Serial peripheral interface, inter integrated circuit, Prototypes:The IMote node architecture, The XYZ node architecture, The Hog throb node architecture | CO1, CO2, CO3 |

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| 3 | **Wireless Communication:** Frequency of Wireless communication Development of Wireless Sensor Network based on Microcontroller and communication device -Zigbee Communication device | CO1, CO2, CO4 |
| 4 | **Power sources:** 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 | CO1,CO5 |
| 5 | **Applications:** Structural health monitoring - sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies, multiple damage detection using mode shapes, coherence, piezoelectric effect, Traffic control, Health care - available sensors, Pipeline monitoring, Precision agriculture, Active volcano, Underground mining | CO1, CO2, CO5 |

| **Learning Resources** |
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| **Text Books** |
| 1. WaltenegusDargie, Christian Poellabauer, Fundamentals of wireless sensor networks : theory and practice - A John Wiley and Sons, Ltd., Publication.<br>2. Subhas Chandra Mukhopadhyay, Smart Sensors, Measurement and Instrumentation , Springer Heidelberg, New York, Dordrecht London, 2013.<br>3. HalitEren,Wireless Sensors and Instruments: Networks, Design and Applications, CRC Press, Taylor and Francis Group, 2006. |
| **Reference Books** |
| 1. UvaisQidwai, Smart Instrumentation: A data flow approach to Interfacing“, Chapman & Hall; 1st Ed,, December 2013.<br>2. Edgar H. Callaway Jr. and Edgar H. Callaway Wireless Sensor Networks: Architectures and Protocols, |
| **e-Resources & other Digital Material** |
| 1. https://nptel.ac.in/courses/117104115<br>2. https://www.scribd.com/document/708102795/Wireless-Instrumentation-eBook<br>3. https://drive.google.com/file/d/12F19IeELeSTmqeH_TVelotKxDP2SAGYn/view<br>4. https://mcet.in/wp-content/uploads/EIE/2020/EIE_QB/Smart%20&%20Wireless%20Instrumentation.pdf |