



Sinhgad Institutes

# Sinhgad Technical Education Society's NHGAD INSTITUTE OF TECHNOLOGY

(Affiliated to University of Pune and Approved by, AICTE, New Delhi.)  
Gat No. 309/310, Kusgaon (Bk), off Mumbai –Pune, Expressway.  
Lonavala, Pune, 410401, Website : [sit.sinhgad.edu](http://sit.sinhgad.edu)

## Department of Electronics and Telecommunication Engineering

### Course Outcomes (COs)

| SE [E&TC] 2019 Pattern |             |                             |   |
|------------------------|-------------|-----------------------------|---|
| SN                     | Course Code | Course Name                 | Course Outcomes (COs)   |
|                        | (207005)    | Engineering Mathematics III | <p><b>CO1:</b>Solve higher order linear differential equation using appropriate techniques for modelling analyzing of electrical circuits and control systems</p> <p><b>CO2:</b>Apply concept of Fourier transform &amp; Z-transform and its applications to continuous &amp; discrete systems, signal &amp; image processing and communication systems.</p> <p><b>CO3:</b>Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.</p> <p><b>CO4:</b>Perform vector differentiation &amp; integration, analyze the vector fields and apply to electromagnetic fields &amp; wave theory.</p> <p><b>CO5:</b>Analyze Complex functions, Conformal mappings, Contour integration applicable to electrostatics, digital filters, signal and image processing.</p> |
| 02                     | (204181)    | Electronic Circuits         | <p><b>CO1:</b>Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.</p> <p><b>CO2:</b>Design MOSFET amplifiers, with and without feedback, &amp; MOSFET oscillators, for given specifications.</p> <p><b>CO3:</b>Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies</p> <p><b>CO5:</b>Explain internal schematic of Op-Amp and define its performance parameters.</p> <p><b>CO6:</b>Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.</p> <p><b>CO7:</b>Understand and compare the principles of various data conversion techniques and PLL with their applications</p>   |
|                        | (204182)    | Digital Circuits            | <p><b>CO1:</b>Identify and prevent various hazards and timing problems in a digital design.</p> <p><b>CO2:</b>Use the basic logic gates and various reduction techniques of digital logic circuit.</p> <p><b>CO3:</b>Analyze, design and implement combinational logic circuits</p> <p><b>CO4:</b>Analyze, design and implement sequential circuits.</p> <p><b>CO5:</b>Differentiate between Mealy and Moore machines.</p>  |



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|----|----------|---------------------|---|
|    |          |                     | <b>CO6:</b> Analyze digital system design using PLD   |
| 03 | (204183) | Electrical Circuits | <p><b>CO1:</b>Analyze the simple DC and AC circuit with circuit simplification techniques.</p> <p><b>CO2:</b>Formulate and analyze driven and source free RL and RC circuits.</p> <p><b>CO3:</b>Formulate &amp; determine network parameters for given network and analyze the given network using Laplace Transform to find the network transfer function.</p> <p><b>CO5:</b>Explain construction, working and applications of DC Machines / Single Phase &amp; Three Phase AC Motors.</p> <p><b>CO6:</b>Explain construction, working and applications of special purpose motors &amp; understand motors used in electrical vehicles.</p> <p><b>CO7:</b>Analyze and select a suitable motor for different applications.</p>   |
| 04 | (204184) | Data Structures     | <p><b>CO1:</b>Solve mathematical problems using C programming language.</p> <p><b>CO2:</b>Implement sorting and searching algorithms and calculate their complexity.</p> <p><b>CO3:</b>Develop applications of stack and queue using array.</p> <p><b>CO4:</b>Demonstrate applicability of Linked List.</p> <p><b>CO5:</b>Demonstrate applicability of nonlinear data structures Binary Tree with respect to its time complexity.</p> <p><b>CO6:</b>Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm</p>  |
| 07 | (204191) | Signals & Systems   | <p><b>CO1:</b>Identify, classify basic signals and perform operations on signals<br/>Identify, Classify the systems based on their properties in terms of input output relation and in terms of impulse response and will be able to determine the convolution between to signals.</p> <p><b>CO2:</b>Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.</p> <p><b>CO3:</b>Resolve the signals in complex frequency domain using Laplace Transform, and will be able to apply and analyze the LTI systems using Laplace Transforms.</p> <p><b>CO4:</b>Define and Describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF.</p> <p><b>CO5:</b>Compute the mean, mean square, variance and</p> |



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|    |          |                                     | standard deviation for given random variables using PDF.   |
| 08 | (204192) | Control Systems                     | <p><b>CO1:</b>Determine and use models of physical systems in form suitable for use in the analysis and design of control systems</p> <p><b>CO2:</b>Determine the absolute stability of a closed loop Control system</p> <p><b>CO3:</b>Perform time domain and frequency domain analysis of control systems required for stability analysis</p> <p><b>CO4:</b>Perform Time domain and frequency domain correlation analysis</p> <p><b>CO5:</b>Apply root locus Frequency plots technique to analyze control system</p> <p><b>CO6:</b>Express and solve system Equation in state variable form.</p> <p><b>CO7:</b>Differentiate between various digital controllers and understand the role of the controllers in Industrial automation.</p>  |
| 09 | (204193) | Principles of Communication Systems | <p><b>CO1:</b>To compute &amp; compare the bandwidth and transmission power requirements by analyzing time and frequency domain spectra of signal required for modulation schemes under study..</p> <p><b>CO2:</b>Describe and analyze the techniques of generation, transmission and reception of Amplitude Modulation Systems.</p> <p><b>CO3:</b>Explain generation and detection of FM systems and compare with AM systems.</p> <p><b>CO4:</b>Exhibit the importance of Sampling Theorem and correlate with Pulse Modulation technique (PAM, PWM, and PPM).</p> <p><b>CO5:</b>Characterize the quantization process and elaborate digital representation techniques (PCM, DPCM, DM and ADM).</p> <p>Illustrate waveform coding, multiplexing and synchronization techniques and articulate their importance in baseband digital transmission.</p> |
| 10 | (204194) | Object Oriented Programming         | <p><b>CO1:</b>Describe the principles of object oriented programming.</p> <p><b>CO2:</b>Apply the concepts of data encapsulation, inheritance in C++</p> <p><b>CO3:</b>Understand Operator overloading and friend functions in C++.</p> <p><b>CO4:</b>Apply the concepts of classes, methods inheritance and polymorphism to write programs C++.</p> <p><b>CO5:</b>Apply Templates, Namespaces and Exception Handling concepts to write programs in C++,</p> <p><b>CO6:</b>Describe and use of File handling in C++.</p>   |



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## Course Outcomes (Cos) 2015 – Pattern

| SE [E&TC] 2015 Pattern |             |                                  |   |
|------------------------|-------------|----------------------------------|---|
| SN                     | Course Code | Course Name                      | Course Outcomes (COs)   |
| 01                     | (204181)    | Signals & Systems                | <p><b>CO1:</b> Understand mathematical description and representation of continuous and discrete time signals and systems.</p> <p><b>CO2:</b> Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.</p> <p><b>CO3:</b> Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.</p> <p><b>CO4:</b> Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.</p> <p><b>CO5:</b> Understand the basic concept of probability, random variables &amp; random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.</p> |
| 02                     | (204182)    | Electronic Devices & Circuits    | <p><b>CO1:</b> Comply and verify parameters after exciting devices by any stated method.</p> <p><b>CO2:</b> Implement circuit and test the performance</p> <p>Analyze small signal model of FET and MOSFET.</p> <p><b>CO3:</b> Explain behavior of FET at low frequency.</p> <p><b>CO4:</b> Design an adjustable voltage regulator circuits simulate electronics circuits using computer</p> <p><b>CO5:</b> simulation software and verify desired results.</p>   |
| 03                     | (204183)    | Electrical Circuits and Machines | <p><b>CO1:</b> Analyze basic AC &amp; DC circuit for voltage, current and power by using KVL, KCL, and network theorems.</p> <p><b>CO2:</b> Design and analyze transformers.</p> <p><b>CO3:</b> Explain the working principle of different DC electrical machines.</p> <p><b>CO4:</b> Explain the working principle of different AC electrical machines.</p> <p><b>CO5:</b> Select proper electrical motor like BLDC, <b>CO6:</b> Reluctance, universal motor for given application.</p> <p><b>CO7:</b> Select proper electrical motor like Stepper motor, Servomotor, Single phase Induction motor for given application.</p>  |
| 04                     | (204184)    | Data Structures and Algorithms   | <p><b>CO1:</b> Discuss the computational efficiency of the principal algorithms</p> <p><b>CO2:</b> Write and understand the programs that use arrays &amp; pointers in C</p> <p><b>CO3:</b> Describe how arrays, records, linked structures are represented in memory and use them in algorithms</p> <p><b>CO4:</b> Implement stacks &amp; queues for various applications</p>  |



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|    |          |                             | <p><b>CO5:</b> Understand various terminologies and traversals of trees and use them for various application</p> <p><b>CO6:</b> Understand various terminologies and traversals of graphs and use them for various applications.</p>   |
| 05 | (204185) | Digital Electronics         | <p><b>CO1:</b> Use the basic logic gates and various reduction techniques of digital logic circuit in detail.</p> <p><b>CO2:</b> Design of combinational circuits.</p> <p><b>CO3:</b> Design of sequential circuits.</p> <p><b>CO4:</b> Design of Sequential circuit using ASM.</p> <p><b>CO5:</b> Design and implement hardware circuit to test performance and application.</p> <p><b>CO6:</b> Understand the architecture and use of microcontrollers for basic operations and Simulate using simulation software.</p>  |
| 06 | (207005) | Engineering Mathematics III | <p><b>CO1:</b> Solve higher order linear differential equation using appropriate techniques for modelling analyzing of electrical circuits and control systems</p> <p><b>CO2:</b> Apply concept of Fourier transform &amp; Z-transform and its applications to continuous &amp; discrete systems, signal &amp; image processing and communication systems.</p> <p><b>CO3:</b> Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.</p> <p><b>CO4:</b> Perform vector differentiation &amp; integration, analyze the vector fields and apply to electromagnetic fields &amp; wave theory.</p> <p><b>CO5:</b> Analyze Complex functions, Conformal mappings, Contour integration applicable to electrostatics, digital filters, signal and image processing.</p> |
| 07 | (204187) | Integrated Circuits         | <p><b>CO1:</b> Understand the characteristics of IC and Op-Amp and identify the internal structure.</p> <p><b>CO2:</b> Derive and determine various performances based parameters and their significance for Op-Amp.</p> <p><b>CO3:</b> Comply and verify parameters after exciting IC by any stated method.</p> <p><b>CO4:</b> Analyze and identify linear applications of Op-Amp.</p> <p><b>CO5:</b> Analyze and identify nonlinear applications of Op-Amp.</p> <p><b>CO6:</b> Understand and verify results (levels of V &amp; I) with hardware implementation. Implement hardwired circuit to test performance and application for what it is being designed.</p> <p><b>CO7:</b> Understand and apply the functionalities of PLL to Frequency synthesizer, multiplier, FM, and AM</p>  |



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|                                   |          |                             | demodulators. Understand and design filters for different cutoff frequencies.   |
| 08                                | (204188) | Control Systems             | <p><b>CO1:</b>Determine and use models of physical systems in form suitable for use in the analysis and design of control systems</p> <p><b>CO2:</b>Determine the absolute stability of a closed loop Control system</p> <p><b>CO3:</b>Perform time domain and frequency domain analysis of control systems required for stability analysis</p> <p><b>CO4:</b>Perform Time domain and frequency domain correlation analysis</p> <p><b>CO5:</b>Apply root locus Frequency plots technique to analyze control system</p> <p><b>CO6:</b>Express and solve system Equation in state variable form</p>   |
| 09                                | (204189) | Analog Communication        | <p><b>CO1:</b>Understand and identify the fundamental concepts and various components of analog communication systems.</p> <p><b>CO2:</b>Evaluation of performance characteristics of AM receiver.</p> <p><b>CO3:</b>Describe the nonlinear modulation techniques with mathematical analysis</p> <p><b>CO4:</b>Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.</p> <p><b>CO5:</b>Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.</p> <p><b>CO6:</b>Describe analog pulse modulation techniques and digital modulation technique.</p> |
| 10                                | (204190) | Object Oriented Programming | <p><b>CO1:</b>Describe the principles of object oriented programming.</p> <p><b>CO2:</b>Apply the concepts of data encapsulation, inheritance in C++.</p> <p><b>CO3:</b> Understand basic program constructs in Java</p> <p><b>CO4:</b>Apply the concepts of classes, methods and inheritance to write programs Java.</p> <p><b>CO5:</b>Use arrays, vectors and strings concepts and interfaces to write programs in Java.</p> <p><b>CO6:</b>Describe and use the concepts in Java to develop user friendly program,</p>  |
| <b>TE [E&amp;TC] 2015 Pattern</b> |          |                             |   |
| 01                                | (304181) | Digital Communication       | <p><b>CO1:</b>Understand working of waveform coding techniques and analyse their performance.</p> <p><b>CO2:</b>Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.</p> <p><b>CO3:</b>Perform the time and frequency domain analysis of the signals in a digital communication system.</p>   |



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|    |          |                           | <p><b>CO4:</b> Represent the signal in its vector and estimate the detected signal with minimum error</p> <p><b>CO5:</b> Design of digital communication system.</p> <p><b>CO6:</b> Understand working of spread spectrum communication system and analyze its performance.</p>   |
| 02 | (304182) | Digital Signal Processing | <p><b>CO1:</b> Analyze the discrete time signals and system using different transform domain techniques.</p> <p><b>CO2:</b> Design and implement LTI filters for filtering different real world signals.</p> <p><b>CO3:</b> Develop different signal processing applications using DSP processor.</p>   |
| 03 | (304183) | Electromagnetics          | <p><b>CO1:</b> Understand the basic mathematical concepts related to electromagnetic vector fields.</p> <p><b>CO2:</b> Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.</p> <p><b>CO3:</b> Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.</p> <p><b>CO4:</b> Understand the concepts related to Faraday's law, induced emf and Maxwell's equations</p> <p><b>CO5:</b> Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation</p> <p><b>CO6:</b> Apply the basic mathematical concepts related to electromagnetic vector fields</p> |
| 04 | (304184) | Microcontrollers          | <p><b>CO1:</b> Selects microcontroller on the basis of performance parameters</p> <p><b>CO2:</b> Writes Programs in Assemble and C<br/>Learn Importance of Microcontroller in designing Embedded applications</p> <p><b>CO3:</b> Learn Use of Hardware and Software tools</p> <p><b>CO4:</b> Develop Interfacing to real world peripheral devices</p> <p><b>CO5:</b> Develop the Data Acquisition System</p>  |
| 05 | (304185) | Mechatronics              | <p><b>CO1:</b> To understand the concept and key elements of Mechatronics system, representation into block diagram</p> <p><b>CO2:</b> To understand principles of sensors their characteristics</p> <p><b>CO3:</b> To Understand of various data presentation and data logging systems</p> <p><b>CO4:</b> To Understand concept of actuator</p> <p><b>CO5:</b> To Understand various case studies of Mechatronics systems</p>  |
| 06 | (304186) | Power Electronics         | <p><b>CO1:</b> Design &amp; implement a triggering / gate drive circuit for a power device</p> <p><b>CO2:</b> Understand, perform different controlled</p>  |



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|    |          |   | <p>converters.<br/> <b>CO3:</b> Analyze different controlled converters.<br/> <b>CO4:</b> Design of power electronics applications like UPS, SMPS<br/> <b>CO5:</b> Evaluate battery backup time &amp; design a battery charger.<br/> <b>CO6:</b> Design &amp; implement over voltage / over current protection circuit.</p>  |
| 07 | (304187) | Information Theory, Coding and Communication Networks | <p><b>CO1:</b> Perform Information theoretic analysis of Communication System<br/> <b>CO2:</b> Design a data compression scheme using Suitable source coding technique<br/> <b>CO3:</b> Design a channel coding scheme for a communication system<br/> <b>CO4:</b> Understand and apply fundamental principles of data communication and networking<br/> <b>CO5:</b> Apply flow and error control techniques in Communication Networks<br/> <b>CO6:</b> Study of Error control techniques</p>        |
| 08 | (304188) | Business Management                                   | <p><b>CO1:</b> Get overview of Management Science aspects useful in business.<br/> <b>CO2:</b> Get motivation for Entrepreneurship<br/> <b>CO3:</b> Get Quality Aspects for Systematically Running the Business<br/> <b>CO4:</b> To Develop Project Management aspect and Entrepreneurship Skills.</p>   |
| 09 | (304189) | Advanced Processors                                   | <p><b>CO1:</b> To understand need and application of ARM Microprocessors in embedded system.<br/> <b>CO2:</b> To study the architecture of ARM series microprocessor<br/> <b>CO3:</b> To learn interfacing of real world input and output devices<br/> <b>CO4:</b> Design embedded system with available resources.<br/> <b>CO5:</b> Use of DSP Processors and resources for signal processing applications.<br/> <b>CO6:</b> To understand architecture and features of typical DSP Processors.</p> |
| 10 | (304190) | System Programming and Operating Systems              | <p><b>CO1:</b> To understand system software concepts, like the use and implementation of assembler, macros, linker, loaders and compiler<br/> <b>CO2:</b> To get acquainted with software tools for program development.<br/> <b>CO3:</b> To explore memory allocation methods, input output devices and file system w. r. t. various operating system<br/> <b>CO4:</b> To study and implement various processes scheduling techniques and dead lock avoidance schemes in operating system.</p>     |

**BE [E&TC] 2015 Pattern**





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| 01 | (404181) | VLSI Design & Technology         | <p><b>CO1:</b>Write effective HDL coding for digital design.</p> <p><b>CO2:</b>Apply knowledge of real time issues in digital design.</p> <p><b>CO3:</b>Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.</p> <p><b>CO4:</b>Design CMOS circuits for specified applications.</p> <p><b>CO5:</b>Analyze various issues and constraints in design of an ASIC</p> <p><b>CO5:</b>Apply knowledge of testability in design and build self-test circuit.</p>   |
| 02 | (404182) | Computer Networks & Security     | <p><b>CO1:</b>To understand state-of-the-art in network protocols, architectures, and applications</p> <p><b>CO2:</b>To provide students with a theoretical and practical base in computer networks issues</p> <p><b>CO3:</b>To outline the basic network configurations To understand the transmission methods underlying LAN and WAN technologies.</p> <p><b>CO4:</b>To understand security issues involved in LAN and Internet.</p>  |
| 03 | (404183) | Radiation & Microwave Techniques | <p><b>CO1:</b>Differentiate various performance parameters of radiating elements.</p> <p><b>CO2:</b>Analyze various radiating elements and arrays.</p> <p><b>CO3:</b>Apply the knowledge of waveguide fundamentals in design of transmission lines.</p> <p><b>CO4:</b>Design and set up a system consisting of various passive microwave components. Analyze tube based and solid state active devices along with their applications.</p> <p><b>CO5:</b>Measure various performance parameters of microwave components.</p>   |
| 04 | (404184) | Elective I (IOT)                 | <p><b>CO1:</b>To understand the fundamental concepts and protocols related to Internet of Things.</p> <p><b>CO2:</b>To study the different sensors,acctuators, IoT standards and APIs for prototyping.</p> <p><b>CO3:</b>To understand the fundamental concepts and protocols related to Internet of Things</p> <p><b>CO4:</b>Understand and apply various IP based protocols for design of IoT systems</p> <p><b>CO5:</b>To be familiar with the big data and cloud in the IoT basis</p> <p><b>CO6:</b>To study the application areas of the Internet of Things.</p> |
| 05 | (404185) | Elective II (EPD)                | <p><b>CO1:</b>Know the basics of product design concept, requirements and specification.</p> <p><b>CO2:</b>Design various stages of hardware from requirements and specifications.</p> <p><b>CO3:</b>Analyse need of software for human interface.</p> <p><b>CO4:</b>Able to explore advance PCB design techniques.</p>   |



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|    |          |                                 | <p><b>CO5:</b>Know the importance of product test &amp; test specifications.</p> <p><b>CO5:</b>Able to define the term documentation and its importance in product design.</p>  |
| 06 | (404189) | Mobile Communication            | <p><b>CO1:</b>Student will be able to describe how wireless networks are penetrating our lives for data, multimedia and voice transmission.</p> <p><b>CO2:</b>Student will be able to analyze different traffic model to predict and measure the propagation loss.</p> <p><b>CO3:</b>Students will understand basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network.</p> <p><b>CO4:</b>Students understand the detailed Architecture of GSM with the call establishment process. They also comprehended the details of mobility management.</p> <p><b>CO5:</b>Students will be able to the necessary relationship to evaluate the performance of CDMA and GSM system</p> <p><b>CO5:</b>Learner would be able to get the overview of LTE architecture, and opportunities and requirements in 5G networks.</p> |
| 07 | (404190) | Broadband Communication Systems | <p><b>CO1:</b>To comprehend the three primary components of a fiber optic communication system.</p> <p><b>CO2:</b>To understand the system design issues and the role of WDM components in advanced light wave systems</p> <p><b>CO3:</b>To understand the basics of orbital mechanics and the look angles from ground stations to the satellite.</p> <p><b>CO4:</b>To apply subject understanding in Link Design.</p> <p><b>CO5:</b>To understand the basics of Satellite and the their structure.</p> <p><b>CO6:</b>To apply understanding in Satellite Design.</p>   |
| 08 | (404191) | Elective III (AVE)              | <p><b>CO1:</b>Apply the fundamentals of Analog Television and Colour Television standards.</p> <p><b>CO2:</b>Explain the fundamentals of Digital Television, DTV standards and parameters</p> <p><b>CO3:</b>Study and understand various HDTV standards and Digital TV broadcasting systems and acquainted with different types of analog, digital TV and HDTV systems.</p> <p><b>CO4:</b>Know advanced TV systems - IP Audio &amp; IP Video, Wi-Fi Audio &amp; Video and 3G transmission.</p> <p><b>CO5:</b>Understand fundamentals of recording and reproductions.</p> <p><b>CO6:</b>Understand acoustic fundamentals and various acoustic systems.</p>   |
| 09 | (404192) | Elective IV (WN)                | <p><b>CO1:</b>Explain various concepts and terminologies used in WSN.</p>   |



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|  |  |  | <p><b>CO2:</b>Describe importance and use of radio communication and link management in WSN.</p> <p><b>CO3:</b>Explain various wireless standards and protocols associated with WSN.</p> <p><b>CO4:</b>Recognize importance of localization and routing techniques used in WSN.</p> <p><b>CO5:</b>Understand techniques of data aggregation and importance of security in WSN.</p> <p><b>CO6:</b>Examine the issues involved in design and deployment of WSN.</p> |
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