

<b>INTERNET OF THINGS</b> <b>(Effective from the academic year 2018 -2019)</b> <b>SEMESTER – VIII</b>			
<b>Course Code</b>	<b>18CS81</b>	<b>CIE Marks</b>	40
<b>Number of Contact Hours/Week</b>	3:0:0	<b>SEE Marks</b>	60
<b>Total Number of Contact Hours</b>	40	<b>Exam Hours</b>	03
<b>CREDITS –3</b>			
<b>Course Learning Objectives:</b> This course (18CS81) will enable students to:			
<ul style="list-style-type: none"> <li>Assess the genesis and impact of IoT applications, architectures in real world.</li> <li>Illustrate diverse methods of deploying smart objects and connect them to network.</li> <li>Compare different Application protocols for IoT.</li> <li>Infer the role of Data Analytics and Security in IoT.</li> <li>Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.</li> </ul>			
<b>Module 1</b>			<b>Contact Hours</b>
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. <b>Textbook 1: Ch.1, 2</b> <b>RBT: L1, L2, L3</b>			08
<b>Module 2</b>			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. <b>Textbook 1: Ch.3, 4</b> <b>RBT: L1, L2, L3</b>			08
<b>Module 3</b>			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. <b>Textbook 1: Ch.5, 6</b> <b>RBT: L1, L2, L3</b>			08
<b>Module 4</b>			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment <b>Textbook 1: Ch.7, 8</b> <b>RBT: L1, L2, L3</b>			08
<b>Module 5</b>			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture,			08

Smart City Use-Case Examples. <b>Textbook 1: Ch.12</b> <b>Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6</b> <b>RBT: L1, L2, L3</b>	
<b>Course Outcomes:</b> The student will be able to :	
<ul style="list-style-type: none"> <li>• Interpret the impact and challenges posed by IoT networks leading to new architectural models.</li> <li>• Compare and contrast the deployment of smart objects and the technologies to connect them to network.</li> <li>• Appraise the role of IoT protocols for efficient network communication.</li> <li>• Elaborate the need for Data Analytics and Security in IoT.</li> <li>• Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.</li> </ul>	
<b>Question Paper Pattern:</b>	
<ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full Question consisting of 20 marks</li> <li>• There will be 2 full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub questions covering all the topics under a module.</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module.</li> </ul>	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"<b>IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things</b>", 1<sup>st</sup>Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)</li> <li>2. Srinivasa K G, "<b>Internet of Things</b>",CENGAGE Learning India, 2017</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. Vijay Madiseti and ArshdeepBahga, "<b>Internet of Things (A Hands-on-Approach)</b>", 1<sup>st</sup>Edition, VPT, 2014. (ISBN: 978-8173719547)</li> <li>2. Raj Kamal, "<b>Internet of Things: Architecture and Design Principles</b>", 1<sup>st</sup> Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)</li> </ol>	
<b>Mandatory Note:</b>	
Distribution of CIE Marks is as follows (Total 40 Marks):	
<ul style="list-style-type: none"> <li>• 20 Marks through IA Tests</li> <li>• 20 Marks through practical assessment</li> </ul>	
<b>Maintain a copy of the report for verification during LIC visit.</b>	
<b>Possible list of practicals:</b>	
<ol style="list-style-type: none"> <li>1. Transmit a string using UART</li> <li>2. Point-to-Point communication of two Motes over the radio frequency.</li> <li>3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).</li> <li>4. I2C protocol study</li> <li>5. Reading Temperature and Relative Humidity value from the sensor</li> </ol>	

<b>STORAGE AREA NETWORKS</b> <b>(Effective from the academic year 2018 -2019)</b> <b>SEMESTER – VII</b>			
<b>Course Code</b>	<b>18CS822</b>	<b>CIE Marks</b>	40
<b>Number of Contact Hours/Week</b>	3:0:0	<b>SEE Marks</b>	60
<b>Total Number of Contact Hours</b>	40	<b>Exam Hours</b>	03
<b>CREDITS –3</b>			
<b>Course Learning Objectives:</b> This course (18CS822) will enable students to:			
<ul style="list-style-type: none"> <li>• Evaluate storage architectures,</li> <li>• Define backup, recovery, disaster recovery, business continuity, and replication</li> <li>• Examine emerging technologies including IP-SAN</li> <li>• Understand logical and physical components of a storage infrastructure</li> <li>• Identify components of managing and monitoring the data center</li> <li>• Define information security and identify different storage virtualization technologies</li> </ul>			
<b>Module 1</b>			<b>Contact Hours</b>
<b>Storage System: Introduction to Information Storage:</b> Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. <b>Data Center Environment:</b> Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application <b>Textbook1 : Ch.1.1 to 1.4, Ch.2.1 to 2.10</b> <b>RBT: L1, L2</b>			08
<b>Module 2</b>			
<b>Data Protection - RAID :</b> RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. <b>Intelligent Storage Systems :</b> Components of an Intelligent Storage System, Types of Intelligent Storage Systems. <b>Fibre Channel Storage Area Networks - Fibre Channel:</b> Overview, The SAN and Its Evolution, Components of FC SAN. <b>Textbook1 : Ch.3.1 to 3.6, Ch. 4.1, 4.3, Ch. 5.1 to 5.3</b> <b>RBT: L1, L2</b>			08
<b>Module 3</b>			
<b>IP SAN and FCoE:</b> iSCSI, FCIP, <b>Network-Attached Storage:</b> General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance <b>Textbook1 : Ch.6.1, 6.2, Ch. 7.1 to 7.8</b> <b>RBT: L1, L2</b>			08
<b>Module 4</b>			
<b>Introduction to Business Continuity:</b> Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions, <b>Backup and Archive:</b> Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments <b>Textbook1 : Ch.9.1 to 9.6, Ch. 10.1 to 10.9</b> <b>RBT: L1, L2</b>			08
<b>Module 5</b>			
<b>Local Replication:</b> Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. <b>Remote Replication:</b> Modes of Remote			08

Replication, Remote Replication Technologies. <b>Securing the Storage Infrastructure:</b> Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking <b>Textbook1 : Ch.11.1 to 11.7, Ch. 12.1, 12.2, Ch. 14.1 to 14.4</b> <b>RBT: L1, L2</b>	
<b>Course Outcomes:</b> The student will be able to :	
<ul style="list-style-type: none"> <li>• Identify key challenges in managing information and analyze different storage networking technologies and virtualization</li> <li>• Explain components and the implementation of NAS</li> <li>• Describe CAS architecture and types of archives and forms of virtualization</li> <li>• Illustrate the storage infrastructure and management activities</li> </ul>	
<b>Question Paper Pattern:</b>	
<ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full Question consisting of 20 marks</li> <li>• There will be 2 full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub questions covering all the topics under a module.</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module.</li> </ul>	
<b>Textbooks:</b>	
1. EMC Education Services, <b>“Information Storage and Management”</b> ,Wiley India Publications, 2009. ISBN: 9781118094839	
<b>Reference Books:</b>	
1. Paul Massiglia, Richard Barker, <b>"Storage Area Network Essentials: A Complete Guide to Understanding and Implementating SANs Paperback"</b> , 1st Edition, Wiley India Publications, 2008	