TEXTBOOKS:
1. Goldberg D.E., Genetic algorithms in search optimization and machining, Pearson Education.
2. S. Russel and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd edition, 2009
3. Tom Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
4. S. Haykin, Neural Networks: A Comprehensive Foundation, 2nd Ed, Pearson Education, 1999
5. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

IT7791   **INTERNET OF THINGS**   **L T P C**
                                                                                          3 0 0 3
OBJECTIVES:
- • To understand Smart Objects and IoT Architectures
- • To learn about various IOT-related protocols
- • To build simple IoT Systems using Arduino and Raspberry Pi.
- • To understand data analytics and cloud in the context of IoT
- • To develop IoT infrastructure for popular applications

UNIT I   FUNDAMENTALS OF IoT   9
Evolution of Internet of Things - Enabling Technologies – Machine to Machine Communication-– Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II   IoT PROTOCOLS   9
Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Layer Protocols: CoAP and MQTT

UNIT III   DESIGN AND DEVELOPMENT   9
Design Methodology - Embedded computing logic - Microcontroller, Zigbee and RFID - Arduino - IDE programming - Raspberry Pi - Interfaces and Python Programming in Raspberry Pi-Web Services.

UNIT IV   DATA ANALYTICS AND SUPPORTING SERVICES   9
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V   CASE STUDIES/INDUSTRIAL APPLICATIONS   9
Connecting IoT to Cloud-Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

TEXTBOOK:
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:
1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.
   https://www.arduino.cc/
   https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

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CT7791 **REFRACTORY ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES
- The course is aimed to impart basic knowledge about the refractory materials, their properties and applications.

UNIT I INTRODUCTION 10
Definition - demand and growth of refractories in India - classification of refractories. Refractory properties: physical properties - microstructure, density, porosity, permeability, pore size distribution; mechanical properties - strength, abrasion resistance, spalling resistance; thermal properties - PCE, RUL, thermal expansion, thermal conductivity, thermal shock resistance; chemical properties - composition, corrosion/slag attack resistance, CO resistance, hydration resistance.

UNIT II TYPES OF REFRACTORIES 9
Acidic refractories - silica, fireclay, high alumina; Basic refractories - magnesia, dolomite, forsterite, magnesia-chrome; Special refractories - SiC, Si_3N_4, carbon, Magnesia carbon, spinel, fused cast refractories.

UNIT III MONOLITHIC REFRACTORIES 9
Castables – types, composition, properties, applications; Plastics – types, composition, properties, applications. Dry mixes – types, composition, properties, applications