|  |  |
| --- | --- |
| **Course Title:** | Internet of Things |
| **Course Code:** | **562CCN-3** |
| **Program:** | **Bachelor of Science in Computer Networks** |
| **Department:** | **Department of Computer Networks** |
| **College:** | **College of Computer Science and Information Systems** |
| **Institution:** | **Najran University** |

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# A. Course Identification

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1. Credit hours: 3(2.2.1)** | | | |  | | | | | | | | | | | | |
| **2. Course type** | | | | | | | | | | | | | | | | |
| **a.** | University | |  | | College | | |  | Department | | | |  | Others |  |  |
| **b.** | | Required | | | |  | Elective | | |  |  | | | | | |
| **3. Level/year at which this course is offered:** | | | | | | | | | | | | **Level 10** | | | | |
| **4. Pre-requisites for this course** (if any)**:**  N/A | | | | | | | | | | | | | | | | |
| **5. Co-requisites for this course** (if any)**:** | | | | | | | | | | | | | | | | |
| N/A | | | | | | | | | | | | | | | | |

## 6. Mode of Instruction (mark all that apply)

| **No** | **Mode of Instruction** | **Contact Hours** | **Percentage** |
| --- | --- | --- | --- |
| **1** | **Traditional classroom** | 75 | 100 |
| **2** | **Blended** |  |  |
| **3** | **E-learning** |  |  |
| **4** | **Distance learning** |  |  |
| **5** | **Other** |  |  |

**7. Contact Hours** (based on academic semester)

|  |  |  |
| --- | --- | --- |
| **No** | **Activity** | **Contact Hours** |
| **1** | **Lecture** | 75 |
| **2** | **Laboratory/Studio** |  |
| **3** | **Tutorial** |  |
| **4** | **Others** (specify) | 45 |
|  | **Total** | 120 |

# B. Course Objectives and Learning Outcomes

|  |
| --- |
| 1. Course Description The Internet of Things (IoT) is a distributed system, in which autonomous devices, sometimes called motes, collect environmental data (such as location, speed, temperature, humidity and sound level) or, more recently, medical data (such as heart rate, blood oxygen level and pulse rate). The data is collected across the network, aggregated and fed into business applications. Sensor and actuator networks, telemetry, data processing, distributed data bases, machine vision, AI and analytics are enablers for various applications, including environmental monitoring and control, agricultural monitoring and control, medical monitoring, habitat monitoring and military surveillance. In this subject, students learn the theory, the concepts and the practice of the new paradigm. By designing and developing a medium-complexity, IoT-based application, students learn new skills, learn the benefits of the technology and explore new models of service deployment and data delivery. |
|  |
| 2. Course Main Objective |
| After completing the course student will be able to    #1 Discuss the theory, concepts, terminologies, architecture of IoT and relevant skills and knowledge gained in IoT as a whole.  #2 Explain an integrated, multidisciplinary approach for IoT based solutions, and apply it to real-world scenarios for building various applications  #3 Explain the principles of sensing/actuation, data transmission and processing, visualization and analytics, as well as, cyber security and privacy issues in IoT.  #4 Analyze, design and implement a distributed IoT system, its components and address its connectivity issues.  #5 Execute independent investigation of new IoT applications, methods, protocols, technologies, programming models and tools, as well as, application development concepts.  #6 Evaluate model applicability, accuracy and limitations  #7 Communicate effectively in ways appropriate to the discipline, audience and purpose  #8 Recognize and appreciate the collaborative nature of IoT development and the teamwork involved |

## 3. Course Learning Outcomes

| **CLOs** | | **Aligned****PLOs** |
| --- | --- | --- |
| 1 | **Knowledge and Understanding** |  |
| 1.1 | Discuss the theory, concepts, terminologies, architecture of IoT and relevant skills and knowledge gained in IoT as a whole | K2 |
| 1.2 | Explain an integrated, multidisciplinary approach for IoT based solutions, and apply it to real-world scenarios for building various applications | K1,K2 |
| 1.3 | Explain the principles of sensing/actuation, data transmission and processing, visualization and analytics, as well as, cyber security and privacy issues in IoT. | K2 |
| 1... |  |  |
| **2** | **Skills :** |  |
| 2.1 | Evaluate model applicability, accuracy and limitations | S1 |
| 2.2 | Analyze, design and implement a distributed IoT system, its components and address its connectivity issues. | S1,S4 |
| 2.3 |  |  |
| 2... |  |  |
| **3** | **Values:** |  |
| 3.1 |  |  |
| 3.2 |  |  |
| 3.3 |  |  |
| 3... |  |  |

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | IoT theory, concepts, components and delivery models | 4 |
| 2 | IoT architecture and topologies | 4 |
| 3 | Networking Basics and Socket Programming | 4 |
| 4 | IoT Standards and Communication Models and Protocols | 4 |
| 5 | Fundamentals of Localization, Aggregation, Clustering and Routing | 4 |
| ... | Sensors and Actuators in IoT | 4 |
|  | Overview of Embedded OS | 4 |
|  | IoT Architecture | 4 |
|  | Issues and Challenges in building IoT applications | 4 |
|  | Applications of RFID Technology | 4 |
|  | IoT Security and privacy standards | 4 |
|  | IoT in Context of Cloud Computing and Analytics | 4 |
|  | IoT and Distributed Data Bases | 4 |
|  | Connectivity, Identification and Localization for IOT and Augmented Reality | 4 |
|  | Scripting Language for Embedded Systems | 4 |
|  |  |  |
| **Total** | | 60 |

# D. Teaching and Assessment

## 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| **Code** | **Course Learning Outcomes** | **Teaching Strategies** | **Assessment Methods** |
| --- | --- | --- | --- |
| **1.0** | **Knowledge and Understanding** | | |
| 1.1 | Discuss the theory, concepts, terminologies, architecture of IoT and relevant skills and knowledge gained in IoT as a whole | Lectures, Small Group Work, Small Group Discussion | Quiz 1,Midterm-1 Exam, Final Exam |
| 1.2 | Explain an integrated, multidisciplinary approach for IoT based solutions, and apply it to real-world scenarios for building various applications. | Lectures, Small Group Work, Small Group Discussion | Quiz 1,Midterm-1 Exam, Final Exam |
| … | Explain the principles of sensing/actuation, data transmission and processing, visualization and analytics, as well as, cyber security and privacy issues in IoT. | Lectures, Small Group Work, Small Group Discussion | Quiz 1,Midterm-1 Exam, Final Exam |
| **2.0** | **Skills** | | |
| 2.1 | Evaluate model applicability, accuracy and limitations | Lectures, Small Group Work, Small Group Discussion | Quiz 1,Midterm-1 Exam, Final Exam |
| 2.2 | Analyze, design and implement a distributed IoT system, its components and address its connectivity issues. | Lectures, Small Group Work, Small Group Discussion | Quiz 1,Midterm-1 Exam, Final Exam |
| … |  |  |  |
| **3.0** | **Values** | | |
| 3.1 |  |  |  |
| 3.2 |  |  |  |
| … |  |  |  |

## 2. Assessment Tasks for Students

| **#** | **Assessment task\*** | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Quiz and Assignment | 2 | 10 |
| **2** | Midterm Examination 1 | 5 | 15 |
| **3** | Midterm Examination 2 | 9 | 15 |
| **4** | Lab Activities | 8 | 10 |
| **5** | Lab Final Examination | 14 | 10 |
| **6** | Final Examination | 15 | 40 |
| **7** |  |  |  |
| **8** |  |  |  |

**\*Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

# E. Student Academic Counseling and Support

|  |
| --- |
| **Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :** |
| Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)    During the whole semester, 10 hours/week are reserved for students to guide them, to help them, to explain them topic which is not clear to them etc. |

# F. Learning Resources and Facilities

## 1.Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | 1. List Required Textbooks  Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846). |
| **Essential References Materials** | Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1 stEdition, VPT, 2014. (ISBN-13: 978-8173719547) 2)  Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2013. (ISBN-13: 978- 1430257400)  Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang Jack Dongarra Geoffrey Fox; ISBN: 9780123858801, Morgan Kaufmann, October 2011  Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, John Wiley & Sons, 2013.  IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter |
| **Electronic Materials** | Available in Blackboard |
| **Other Learning Materials** |  |

## 2. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**  (Classrooms, laboratories, demonstration rooms/labs, etc.) | * Lecture Rooms with 20 seats with smart table, Mic, Speaker, PC, Auto Projector with Screen and a white board or a smart board (male Section). * IoT Lab. |
| **Technology Resources**  (AV, data show, Smart Board, software, etc.) | * Desktop/ Laptop computer Multimedia Projector * Laboratory contains an enough number of PC to accommodate all students with Java-related software like JCreator , J2SE , NetBean, Eclipse and JRE licensed version with network package should be installed. |
| **Other Resources**  (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | A File cabinet to keep class stuffs, papers and students files, and a printer to print program screen shots. |

# G. Course Quality Evaluation

| **Evaluation**  **Areas/Issues** | **Evaluators** | **Evaluation Methods** |
| --- | --- | --- |
| Feedback about Course Learning Outcomes (CLOs) | Students, Faculty | Direct (A course survey is distributed to students to take their opinion) |
| feedback about the teaching strategies, assessment methods, textbooks, instructor | Students | Direct (A course survey is distributed to students to take their opinion) |
| feedback about the teaching strategies, assessment methods, textbooks, instructor | Faculty | Direct (Meeting with course coordinator and college coordinator periodically.) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

# H. Specification Approval Data

|  |  |
| --- | --- |
| **Council / Committee** |  |
| **Reference No.** |  |
| **Date** | January 19, 2019 |