# INTERNET OF THINGS (IoT) AND APPLICATIONS
## (ECEN 6132)

**Time Allotted : 2½ hrs**                                    **Full Marks : 60**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

## Group – A

1.  Answer any twelve:                                    **12 × 1 = 12**

    *Choose the correct alternative for the following*

    (i)    How many main components IoT mainly consists of?
           (a) 2              (b) 3              (c) 4              (d) 5.

    (ii)   The SOA architecture is divided into how many layers?
           (a) 5 layers                      (b) 6 layers
           (c) 7 layers                      (d) 2 layers.

    (iii)  Which of the following is the way in which an IoT device is associated with data?
           (a) Internet                      (b) Cloud
           (c) Automata                      (d) Network.

    (iv)   Which of the following layers provides end-to-end communication in IoT?
           (a) Logical layer                 (b) Data link layer
           (c) Transport layer               (d) Session layer.

    (v)    Which of the following topology is used for ZigBee Smart Energy?
           (a) Bus Topology                  (b) Ring Topology
           (c) Star Topology                 (d) Any Topology.

    (vi)   Which of the following computing emphasizes proximity to end user?
           (a) Mist computing                (b) Cloud computing
           (c) Edge computing                (d) Fog computing.

    (vii)  What is the full form of ICT?
           (a) Inter Connect Technology
           (b) Internet Connection Topology
           (c) Information and Communication Technology
           (d) Infer Communication Topology.

    (viii) 6LoWPAN Adaption layer contains?
           (a) Header compression            (b) Fragmentation
           (c) Layer 2 forwarding            (d) All of these.

(ix)    The Bluetooth technology operates in the ISM band at _____
        (a) 2.4 to 2.485 GHz                    (b) 1.4 to 2.485 GHz
        (c) 2.4 to 2.485 MHz                    (d) None of the above.

(x)     WSN stands for _____
        (a) Wired Sensor Network               (b) Wireless Sensor Network
        (c) Wired Service Network              (d) Wireless Service Network.

*Fill in the blanks with the correct word*

(xi)    _____ are the devices that are able to emit, accept and process data over the network.

(xii)   _____ in the IoT Architecture is the hardware and software gateways that analyze and pre-process the data before transferring it to the cloud.

(xiii)  An IoT network is a collection of _____ devices.

(xiv)   The standard length of the MAC address is_____.

(xv)    The bit length of the IPV6 is _____.

# Group - B

2.  (a)  What are the various types of deployment challenges associated with the IoT system? Explain briefly.                              *[(CO1,CO2)(Analyse/IOCQ)]*
    (b)  Why collected data filtering and optimization of power consumption is necessary for IoT based sensors?                    *[(CO1,CO2)(Evaluate/HOCQ)]*
    (c)  What is the signification of IoT actuators?                    *[(CO4)(Apply/IOCQ)]*
                                                                        **5 + 5 + 2 = 12**

3.  (a)  Show the difference between OSI model and the TCP/IP model for layers.
                                                                        *[(CO3)(Analyse/IOCQ)]*
    (b)  Write down the equation for total end-to-end delay in a IoT network. Why do Transmission delay and Propagation delay take place?    *[(CO3)(Evaluate/HOCQ)]*
                                                                        **6 + 6 = 12**

# Group - C

4.  (a)  What is the definition of a *Sensor* in IoT? List the top *Sensor Characteristics* and explain their uses in IoT?                    *[(CO4)(Remember/LOCQ)]*
    (b)  Why are actuators required in IoT networks? What are the key differences between Sensors and Actuators?                    *[(CO4)(Remember/LOCQ)]*
    (c)  Describe how RFID works and list major component of RFID.    *[(CO4)(Evaluate/HOCQ)]*
                                                                        **(1 + 4) + (2 + 2) + 3 = 12**

5.  (a)  What is *IoT Reference Model*? Draw the block diagram and explain the functions of the models.                              *[(CO3,CO5)(Remember/LOCQ)]*
    (b)  Highlight the main design principles of IoT.                    *[(CO3,CO5) (Analyse/IOCQ)]*
                                                                        **(1 + 7) + 4 = 12**

# Group - D

6.  (a)   Define interoperability. Explain technical, syntactical and semantic interoperability. *[(CO5)(Remember/LOCQ)]*
    (b)   Mention and explain at least 5 security challenges faced in IoT networks.
    *[(CO5)(Remember/LOCQ)]*
    **6 + 6 = 12**

7.  (a)   What is the definition of Fog computing. Will Fog computing replace Cloud computing? What are the characteristics that uniquely distinguish Fog from Cloud computing? *[(CO4)(Analyse/IOCQ)]*
    (b)   When is Linear Regression analysis model required? Show mathematically how Customer Lifetime Value (CLV) can be modelled using RFM predictors. What are decision trees? What are the key decisions to build a tree using algorithms like CART or CHAID? *[(CO4)(Analyse/IOCQ)]*
    **(2 + 2 + 2) + 6 = 12**

# Group - E

8.  (a)   Electric Vehicle (EV) charging have to address a number of challenges. Mention three of them and explain the challenges and possible solutions.
    *[(CO5,CO6)(Remember/LOCQ)]*
    (b)   What are the different charging modes prescribed by IEC? Explain modes 1 and 3. *[(CO5,CO6)(Analyse/HOCQ)]*
    (c)   Explain how the pilot wire circuit as per IEC 61851 works. Explain with the help of a circuit diagram. *[(CO6)(Analyse/HOCQ)]*
    **3 + 4 + 5 = 12**

9.  (a)   How can IoT play an important role in public safety and protection of environment? Explain. *[(CO6)(Evaluate/HOCQ)]*
    (b)   How can IoT make agriculture sector smart? *[(CO6)(Evaluate/HOCQ)]*
    **6 + 6 = 12**

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| Cognition Level | LOCQ | IOCQ | HOCQ |
|---|---|---|---|
| Percentage distribution | 33.33 | 30.21 | 36.46 |

**Course Outcome (CO):**

After the completion of the course students will be able to
1.   Understand different protocols.
2.   Analyze IoT architecture.
3.   Design applications based on IoT.
4.   Create sensor based applications.
5.   Develop new applications.
6.   Compare different IoT uses.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*