COURSE CODE (CREDITS): 21M1WEC233 (3)   MAX. MARKS: 35

COURSE NAME: Applied Machine Learning for IoT

COURSE INSTRUCTORS: Dr. Vikas Baghel   MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. Consider a single unit in a neural network that receives two binary inputs x_1, x_2 and **[5] [CO1]** computes a linear combination followed by a threshold activation function, namely

$$\sigma(z) = \begin{cases} 1 & z \geq 0 \\ 0 & otherwise \end{cases}$$

We have chosen a bias term of $b = 5$. Provide values for the two weights w_1 and w_2 that allow you to compute the NAND function.

Q2. Write short notes on: **[CO4]**

  a) Key benefits of cloud technology   **[1]**

  b) Virtualization and Containerization   **[2]**

  c) Fog and Edge computing   **[2]**

Q3. **a)** A car moves with a speed of 30 km/hr. What will be the speed of the same car **[3] [CO2]** measured by a speed sensor which is placed in a truck which is moving with a speed of 20 km/hr in the same direction? Draw the flowchart to describe the steps to simulate this process.

  b) What is relay? Explain the working principle and what are the applications?   **[2]**

  c) A newly hired chemical engineer at Hypothetical Industries is responsible for **[3]** monitoring and maintaining temperatures for one of the company's exothermic reactions. The process uses a platinum resistor thermometer to measure the temperature of the process, the properties of which are given below. The reaction's ideal range is between 250°C – 350°C. Below 250°C, the catalyst ceases to function, and above 350 °C, it can be classified as a runaway reaction. The engineer can control steam and cooling water to regulate the process temperature. Describe what changes the engineer should make to either the flow

rate of the coolant or the steam to keep the system functioning optimally.

Case I: $R_T = 25 ohms$

Case II: $R_T = 13.9 ohms$

Case III: $R_T = 19.4 ohms$

GIVEN DATA:

$$R_T = R_0(1 + a_1 T + a_2 T^2)$$

$R_0 = 10 \ ohms$

$a_1 = 3.91 \times 10^{-3}(°C)$

$a_2 = -6.72 \times 10^{-8}(°C)$

Q4. a) What is Tensorflow? What are the features of TensorFlow? Describe the common steps to most TensorFlow algorithms? [2] [CO4]

b) What do you mean by Graph and Placeholder in TensorFlow? Explain with proper block diagram. Differentiate between tf.variable and tf.placeholder. [2]

c) Explain few options to load data into TensorFlow in detail. [1]

Q5. a) Explain the code: [2] [CO4]

```
for epoch in range(training_epochs):
for (x, y) in zip(train_X, train_Y):
sess.run(optimizer, feed_dict = {X:x, Y:y})
```

b) Write a program to predict the age using regression model. Data can be fetched from available CSV file with file name *data.csv.* [5]

Q6. a) What mode does the ESP8266 WiFi Module switch to when fed the sequence 1 1 to its GPIO-0 and GPIO-2 Pins? [1] [CO5]

b) Explain the designing of a heart-rate monitor system using IoT & Machine Learning with proper diagram. Also mention the types of sensors and boards are required for this application. [4]