Mr Mohit Garg.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -2 EXAMINATION- MARCH 2019
B. Tech 8th Semester

COURSE CODE: 18B1WEC837 **MAX. MARKS: 25**
COURSE NAME: THEORY AND APPLICATION OF INTELLIGENT SYSTEMS
COURSE CREDITS: 3 **MAX. TIME: 1.5 Hrs.**

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

1. Draw the models of artificial neuron and biological neuron. **[2 marks]**
2. How neural network is used in system identification? Explain with example. **[2 marks]**
3. Explain Pseudo-inverse technique for radial basis functions network learning. **[3 marks]**
4. State Lyapunov's stability theory for nonlinear systems. Mention the properties of Lypaunov's function. **[3 marks]**
5. Define k-means clustering for RBFN. Distinguish between radial basis function network and multi-layer neural network. **[4 marks]**
6. Check the stability of the equilibrium state of the system described by

$$\dot{x}_1 = x_2$$
$$\dot{x}_2 = -x_1 - x_1^2 x_2$$

Show that the Lyapunov's linealization method fails while the Lypanunov's direct method can easily solve this problem. **[4 marks]**

7. An undamped pendulum is described by the diffrential equation-

$$ml^2\ddot{\theta} + mgl\sin\theta = 0$$

Where mg is the weight of the pendulum and l is its length. Show that this nonlinear system has two equilibrium points: $\theta = 0, and\ \theta = \pi$. Also develop linear state models using Taylor series approximation around the two equilibrium points. **[4 marks]**

8. Consider the solution of X-OR problem using neural network. An XOR gate cannot be implemented by a single perceptron due to nonlinear separability property of the input pattern. However, suppose the following pair of Gaussian hidden functions are defined:

$$h_1(x) = e^{-\|x-u_1\|^2} \qquad u_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$h_2(x) = e^{-\|x-u_2\|^2} \qquad u_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

Calculate $h_1(x)$, $h_2(x)$ for the input patterns and draw the graph of the outputs in the $h_1 - h_2$ space. **[3 marks]**