Date 19/5/26 12:00 P.M.

(153)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B.Tech-VI Semester (ECE)

COURSE CODE (CREDITS): 18B1WEC632 MAX MARKS: 35

COURSE NAME: ITELLIGENT CONTROL SYSTEMS

COURSE INSTRUCTOR: Dr Rajiv Kumar MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*
(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems
(c) Use of scientific calculator is allowed

Q.No	Question	CO	Marks
Q1	**(A)** Explain the concept of an Intelligent Control System. Discuss the role of machine intelligence in modern automation systems. **(B)** A smart industrial temperature control system uses a temperature sensor having a sensitivity of 12 mV/°C. During operation, the sensor produces an output voltage of 480 mV. Determine the measured temperature. **(C)** Describe the functions of Sensors, Actuators, Controllers, and External I/O devices in intelligent control applications with suitable examples.	CO-1	2+1.5+1.5=05
Q2	**(A)** A neuron receives inputs $x_1 = 0.5$, $x_2 = 0.8$ with corresponding weights $w_1 = 0.6$, $w_2 = 0.4$, and bias $b = 0.2$. Calculate the net input using $y = \sum w_i x_i + b$ **(B)** Explain the architecture and working of an Artificial Neural Network (ANN). Discuss different layers used in ANN. **(C)** Explain the advantages of ANN in control system design.	CO-4	2+1.5+1.5=05
Q3	**(A)** Compare Liapunov's method with conventional stability techniques used in control systems. **(B)** Differentiate between stable, asymptotically stable, and unstable systems with suitable examples. **(C)** For the nonlinear system $\dot{x}_1 = -2x_1 + x_2, \qquad \dot{x}_2 = -x_1 - 3x_2$ consider the Liapunov candidate function $V(x) = x_1^2 + x_2^2$ Given system is stable, asymptotically stable, and unstable system.	CO-4	1.5+1.5+2=05

Q4	**(A)** Explain why the concepts of robust stability and robust performance both are important in practical control system design. **(B)** A control system parameter has a nominal value of 10, but due to uncertainty it may vary by ±15%. Determine, whether the system can be considered robust if the acceptable parameter range is from 8 to 12.	CO-3	2.5+2.5=05
Q5	**(A)** Discuss the control challenges in Robot Manipulator Control systems. Explain how intelligent control techniques improve performance. **(B)** Explain the role of adaptive and intelligent control in Flight Control Systems. Discuss stability enhancement methods used in aircraft control. **(C)** An aircraft control system experiences a disturbance causing the output angle to change from 10° to 14°. Calculate the percentage change in output.	CO-4	2+1.5+1.5=05
Q6	**(A)** Describe how Artificial Neural Networks and Adaptive Controllers can be combined to achieve intelligent and robust control in modern engineering systems. **(B)** A control system has nominal gain K = 20. Due to parameter variation, the gain changes to K = 24. Calculate the percentage variation in system gain.	CO-3	2.5+2.5=05
Q7	**(A)** Differentiate between Direct and Indirect Adaptive Control with suitable example. **(B)** Explain the principle and operation of a Self-Tuning Regulator (STR). **(C)** A first-order adaptive control system has plant transfer function: G(s)=K/(Ts+1) where initially K=2 and T=1. Due to parameter variation, K changes to 5. Determine the percentage change in system gain.	CO-4	2+1.5+1.5=05