JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- October 2017

B. Tech VIIth Semester

COURSE CODE: 17B1WEC733   MAX. MARKS: 25

COURSE NAME: **ROBOTIC SYSTEMS AND CONTROL**

COURSE CREDITS: 3   MAX. TIME: 1hr 30 min

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

1. [4 marks] The open loop transfer function of a unity feedback system is

$$G(s) = \frac{K}{s(s+2)}$$

The system is required to meet the following specifications: Peak time, t_p = 1 sec., Peak overshoot, M_p = 10%. Can we find a value of K to meet both these specifications? If not, suggest a suitable control method to meet these two performance specifications.

Given $t_p = \dfrac{\pi}{\omega_n \sqrt{1-\xi^2}}$, $M_p = e^{-\pi\xi / \sqrt{1-\xi^2}}$

2. [5 marks] What is a PID controller? How to tune its parameters? Design a PID controller for the given transfer function using Ziegler-Nichols tuning method.

$$G_p(s) = \frac{1}{(s+1)(5s+1)(0.2s+1)}$$

3. [6 marks] Explain the block diagram of robotic closed loop system. Define the sensors and controller. Explain any two internal state sensors.

4. [4 marks] What do you mean by dynamics and control of robotic system? Discuss the challenges for a control engineer for analysis and synthesis of robotic systems?

5. [1.5 marks each] Write Short Notes on:

a) System modeling   b) Trajectory tracking
c) Forward and inverse kinematics   d) Transfer function vs. State-space approach