JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

B.Tech-III Semester (ECE)

COURSE CODE(CREDITS): 18B11EC311(3) MAX. MARKS: 25

COURSE NAME: Automatic Control Systems

COURSE INSTRUCTORS: Dr Rajiv Kumar MAX. TIME: 1 Hour 30 Minutes

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Note: *(a)All questions are compulsory.*

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

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Qu-1: a) Explain, why second order systems are most often used for analyzing the control system.

b) Derive the expression of peak percent overshoot. Prove that peak overshoot is a monotonically decreasing function of damping and is independent of undamped natural frequency.

c) Measurements conducted on a servomechanism show the system response to be

$$c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$$

Obtain the expression of closed-loop transfer function and damping ration when subjected to a unit-step input.

[1+2+2, CO-2]

Qu-2: a) What do you mean by the following two kinds of stability:

i) Bounded input, and bounded output stability
ii) Asymptotic stability

b) A feedback system has an open-loop transfer function of

$$G(s)H(s) = \frac{Ke^{-s}}{s(s^2 + 5s + 9)}$$

Determine by use of the Rout criterion, the maximum value of K for the closed-loop system to be stable.

[2+4, CO-1]

Qu-3: a) Sketch manually the root-locus plot of a unity feedback system with the following characteristic equation:

$$s^2 + 6s + 8 + K = 0$$

b) Using root-locus technique, draw the root-locus plot for a feedback system with having the following characteristic equation:

$$1 + K\frac{1}{s(s+1)(s+2)} = 0$$

[3+3, CO-3]

Qu-4: Draw the Polar plot of the following systems for which transfer functions are:

i) $G(s) = s$

ii) $G(s) = 2 + s$

iii) $G(s) = 1/(1+s)$

iv) $G(s) = \frac{1}{s(s+2)}$

[4, CO-4]

Qu-5: Draw the Bode plot for the transfer function $G(s) = \frac{64(s+2)}{s(s+0.5)(s^2+3.2s+64)}$

[4, CO-4]