TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

DICE5, DEPE5, DTIE5

ECI 2301

CONTROL SYSTEMS II

END OF SEMESTER EXAMINATIONS

SERIES: MAY 2016

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1) You should have the following for this examination;
    - Answer booklet
    - Non-programmable calculator
2) Answer any THREE Questions

QUESTION 1.

a) State 3 disadvantages of Hurwitzs criterion . (3 marks)

b) What does a change of sign in the first column of Rouths Array indicates. (2 marks)

c) The open loop transfer function of a unity negative feedback control system is given by

$$G(S) = \frac{K}{S(S^2 + S + 3)(5 + 6)}$$

1. Determine the characteristic equation.
2. Construct the Routh array table.
3. The the range g 1c for stability? (15 marks)

QUESTION 2.

(a) What does angle of departure and angle of arrival mean in root loans? (4 marks)

(b) For a unity feedback system having forward transfer innetion?

$$G(S) = \frac{K}{S(1 + 0.6S)(1 + 0.4S)}$$ (16 marks)

Determine the range of value K, marginal value of k, and the frequency of sustained oscillation?

QUESTION 3.

a) Define centre of asymptotes? (3 marks)

b) State 3 effects of additionof zeros?

c) The open-loop transfer function of a unity feedback control system is

$$G(S) = \frac{K}{S(S + 0.4)(S + 0.6)}$$

Draw the root locus of the system and find the G K for damping ratio 0.5 (14 marks)

QUESTION 4.

a) State the steps to plot a bode plot? (6 marks)

b) A feedback control system has an open loop transfer founction.

$$G(S) = \frac{20}{S(S + 2)}$$

Draw the bode plot? (14 marks)

QUESTION 5.

a) State the Nyquist stability criterion

b)A feedback control system has an open loop transfer function

$$G(S) = \frac{1}{(S^2 + 2S + 4)}$$

Plot the Nyquist diagram and hence determine

i. Gain margin

ii. Phase marine

iii. State whether the system is stable or unstable giving reasons for your answer. (18 marks)