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)What do you mean by stability, absolute stability and conditional stability?   (6 marks)
b)State Routh – Hurwitz criterion? (2 marks)
c)The open loop transfer function of a unity negative feedback control system is given by

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

i.Determine the characteristic equation?
ii.Construct the Routh table?
iii.Determine the range of K for stability?   (12 marks)

QUESTION 2.
 a)For a unit feedback system having forward transfer founction

$$G(S) = \frac{K}{S(1 + 6S)(1 + 4S)}$$ (16 marks)

Determine the range of value K, marginal value of k, and the frequency of sustained oscillation?
b) What do you mean by Break-away/Break-in Point.   (4 marks)

QUESTION 3.
a)What do the term Root locus mean?   (2 marks)
b)State 4 effects of addition of poles? (4 marks)
c)The open-loop transfer founction of a unity feedback control system is

$$G(S) = \frac{K}{S(S + 4)(S + 5)}$$

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

QUESTION 4.
a)State the steps to plot a bode Plot   (6 marks)
b)A unity feedback control system has

$$G(S) = \frac{400(S + 2)}{S^2(S + 5)(S + 10)}$$

Draw the bode plote? (14 marks)

QUESTION 5.
a) State the Nyquist stability criterion. (6 marks)
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.   (14 marks)