KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCE 322: TRANSMISSION LINES AND WAVE GUIDES

DATE: **Thursday 19th April 2012** **TIME:** **2.00p.m – 4.00p.m**

INSTRUCTIONS:

(i) There are **Five** questions.

(ii) Question No.1 is **Compulsory** and carries **30 Marks.**

(iii) Select any **other Two** questions, each of which carries 20 Marks.

(iv) Define all symbols used.

(v) Marks will be awarded for procedure, methodologies used and not necessarily on the final answer.

Q1. (a) (i) Name the types of lines used in Transmission. (3 MARKS)

(ii) Describe what a *Wave Guide* is and give the types of modes of propagation used. (3 MARKS)

(ii) Given a receing end impendance is $Z_R = 420 + j45\ \Omega$ on a line whose characteristic impedance, Z_o, is $100 + j0\ \Omega$, derive the normalised receiving end impedance. (4 MARKS)

(b) (i) Explain what Voltage Standig Wave Ratio (VSWR) is. (4 MARKS)

(ii) For a typical Transmission Line, define:-

1. Reflection Coeffcient, K. (2 MARKS)
2. Ttransfer Impedance. (2 MARKS)

(iii) What are MASERS and LASERS? (2 MARKS)

(c) (i) Write the expression for the cut off frequency of TE mode porpagated between parallel plates of legth a and b equivalent to sides of a rectangular Wave Giude. (5 MARKS)

(ii) With the aid of a suitable schematic diagram, explain how impedance matching on a Transmission Line is achieved using a Stub. (5 MARKS)

Q2. Consider a 100Km telephone line which has $Z_o = 685 - j92\ \Omega$, $\alpha = 0.00497$ per km, $\beta = 0.0352$ radians per km at 1,000Hz. If the Line is terminated at $Z_R = 2000 + jo\ \Omega$:-

(i) Obtain the normalised receiving end impedance and indicate its location on the Smith Chart. (5 MARKS)

(ii) Derive the receiving end and sending end reflection coefficient. (5 MARKS)

(iii) Determine the normalised sendig end impedance. (5 MARKS)

(iv) Find the receiving end impedance of the Line. (5 MARKS)

Q3. (a) (i) Distinguish between Transfer Impedance and Characteristic Impedance for a given Transmission Line. (4 MARKS)

(ii) Show that a Transmission Line terminated at its Characteristic Impedance has no reflection. (6 MARKS)

(b) (i) Define microwaves and show why special structures are neccessary for their transmission. (7 MARKS)

(ii) Using suitable schematic diagrams describe three methods of coupling energy in a wave guide. (3 MARKS)

Q4. (a) Descuss the Electromagnetic Wave Theory. (8 MARKS)

(b) Give the physical interpretation of the following Maxwell's equations:-

(i) $\nabla.B = 0$, (ii) $\nabla.B = \rho$ (12 MARKS)

Q5. (a) The transverse magnetic mode (TM_{mm}) is a the longitudinal field with $H_z = 0$ and E_z component given by:-

$$E_z = E_o \mathrm{Sin}\left(\frac{m\pi x}{a}\right)\mathrm{Sin}\left(\frac{n\pi y}{b}\right) e^{j(\omega t - \beta z)}$$

Derive the following components:- E_z, E_y, H_x, and H_y. (14 MARKS)

(b) Give Maxwell's equations for a conducting medium. (6 MARKS)

The Complete Smith Chart

Black Magic Design