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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

FIFTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN ELECTRICAL AND COMMUNICATIONS ENGINEERING

COURSE CODE: ECE 514

COURSE TITLE: TRANSMISSION LINES

DATE: 15TH DECEMBER, 2022 **TIME:** 3: 00 PM – 5:00 PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

MMUST observes ZERO tolerance to examination cheating

Question 1 **[30marks]**

(a) State any THREE applications of transmission lines [3marks]

(b) A lossless line has a characteristic impedance of 400Ω. Determine the standing wave ratio if the receiving end impedance is 800Ω. [3marks]

(c) Explain briefly any THREE types of transmission lines [3marks]

(d) A transmission line has a characteristic impedance of $710 < -16^{\circ}\ \Omega$ at 1KHz. At this frequency, the attenuation and phase shift is found to be 0.01 neper and 0.035 radian per km respectively. Determine the primary constants of the line.

[8marks]

(e) An open telephone line has R=10Ω/km, L=0.0035H/km, C=0.0053μF/km and G=0.4μS/km. Given the operating frequency as 1000Hz, determine;

(i) Characteristic impedance [3marks]
(ii) Attenuation constant [3marks]
(iii) Phase constant [3marks]

(f) A 2.5m long 75Ω coaxial cable is connected to a generator at one end and to a load of 75+j25Ω at the other end. The generator has an open circuit r.m.s voltage of 10V and an internal resistance of 50Ω. Determine the power delivered to the load. The frequency of operation is 150MHz and the velocity of the wave on the cable is $2 \times 10^{8} ms^{-1}$. [4marks]

Question 2 **[20marks]**

(a) Explain briefly the primary constants of a transmission line [4marks]

(b) A 50Ω lossless transmission line is connected to a load of 50+j50Ω. The maximum voltage measured on the line is 50V. Determine the power delivered to the load and the peak voltage at the load end of the line. [4marks]

(c) A 100Ω lossless transmission line is to be matched with a 50 – j75 Ω load using a single stub. Calculate the stub length and its distance from the load using a Smith Chart. [7marks]

(d) A 50Ω transmission line is connected to a parallel combination of 100Ω resistance and a 1nF capacitance. Determine;

(i) Voltage standing wave ratio on the line at a frequency of 2MHz [3marks]

(ii) Maximum and minimum resistance seen on the line. [2marks]

Question 3 **[20marks]**

(a) Explain the THREE types of loading in transmission lines [6marks]

(b) A generator of 1V, 1KHz supplies power to a 100km long line terminated in Z_o and having the following constants; R=10.42Ω/km, L=0.00367H/km, G=0.8×10^{-6}S/km, C=0.00835×10^{-6}F/km. Determine;

(i) Characteristic impedance [3marks]
(ii) Attenuation and phase constant [3marks]
(iii) Wavelength and velocity of propagation [4marks]

(c) A transmission line 10km long is terminated properly at the far end at a frequency 1000Hz. The attenuating and phase constants of the line are 0.03Np/km and 0.03radians/km respectively. If the far end voltage at 1000Hz is $4\angle 0\ ^{o}V$. Determine the sending end voltage of the line. [4marks]

Question 4 **[20marks]**

(a) Explain the THREE losses in a transmission line [6marks]

(b) A lossless transmission line used in a television receiver has capacitance of 50pF and an inductance of 200nH/m. Determine the characteristic impedance for sections of a line 10m long and 500m long. [6marks]

(c) A lossless transmission line is terminated in a load impedance of $30 - j23\ \Omega$. Determine the phase constant and the reflection coefficient of a line of length 50 m. The characteristic impedance, $Z_0 = 50\Omega$ and wavelength on the line $\lambda = 0.45$ m. [4marks]

(d) The characteristic impedance of a uniform transmission line is 2309.6Ω at a frequency of 800MHz. At this frequency, the propagation constant is 0.0366+j0.99 Ω. Determine resistance and inductance of the line. [4marks]

Question 5 **[20marks]**

(a) Explain the FOUR applications of Smith chart. [4marks]

(b) A 50Ω lossless transmission line is terminated in a load of impedance of 25+j50 Ω. Use the Smith chart to find the;

(i) Voltage standing wave ratio [4marks]
(ii) Voltage reflection coefficient [4marks]
(iii) Input impedance of the line given that the line is 0.3λ long. [3marks]

(c) A transmission line is lossless and is 25m long. It is terminated in a load of Z_L=40+j30 Ω at a frequency of 10MHz. the inductance and capacitance of the line are L=300nH/m, C=40pF/m. Determine the input impedance at the source and at the mid-point of the line. [5marks]