INTI
INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session : August 2012

Programme : Diploma in Electrical and Electronic Engineering

Course : EEE1104: ELECTRICAL MEASUREMENTS AND TRANSMISSION

Date of Examination : 10 December 2012

Time : 11a.m. – 1p.m. Reading Time: Nil

Duration : 2 Hours

Special Instructions :

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-programmable calculator

Materials provided :

Nil

Examiner(s) : **Alan Wong Kam Mun**

Moderator : **Shalyn Lim**

This paper consists of 5 printed pages, including the cover page.

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)

EEE1104: ELECTRICAL MEASUREMENTS AND TRANSMISSION
FINAL EXAMINATION: AUGUST 2012 SESSION

Instructions: This paper consists of SIX (6) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks.

Question 1

Electrical instruments in a very broad sense can be divided into absolute instruments and secondary instruments. The secondary instruments are most generally used in everyday work.

(a) Name the 3 torques acting on the instrument analogue moving system and describe their functions.

(6 marks)

(b) The rate of change of inductance in a moving iron ammeter is 2 μH/degree. The control spring constant is 5×10^{-7} N-m/degree. Given that the maximum deflection of the pointer is 100°, calculate the current corresponding to the maximum deflection.

(10 marks)

(c) A moving coil voltmeter has a resistance of 20 Ω and full scale deflection of 120° is reached when a potential difference of 100 mV is applied across its terminal. The moving coil has the effective dimensions of 3.1cm x 2.6 cm and is wound with 120 turns. The flux density in the gap is 0.15 Wb/m^2. Determine the control constant of the spring and suitable diameter of copper wire for coil winding if 55% of total instrument resistance is due to coil winding.
Resistivity ρ for copper is 1.73×10^{-6} Ω-cm.

(9 marks)

Question 2

(a) A moving-coil instrument gives full-scale deflection with 15 mA and has resistance of 5 Ω. Calculate the shunt resistance required to enable the instrument to read up to 2A. If the shunt is to be made from a strip of material with cross section 0.2 mm x 5 mm, having a resistivity of 49×10^{-8} Ω-m, what length of material is required?

(9 marks)

(b) A moving coil galvanometer has a resistance of 5Ω and gives full-scale deflection when a current of 20mA flows through it. Calculate the series resistor required and show the necessary arrangement to convert it into a multi-range voltmeter with range 0 – 3V, 0 – 12V and 0 – 50V. Draw the circuit diagram.

(9 marks)

(c) A voltmeter is connected across the series combination of an ammeter and a resistor. The readings on the meters are 12V and 50mA, respectively. If the resistance of the ammeter is 40 Ω, calculate:

(i) the resistance of the resistor. (4 marks)

(ii) the accuracy of the measured resistance. (3 marks)

Question 3

(a) Calculate the iterative impedances and image impedances of the network shown in Figure Q3. (10 marks)

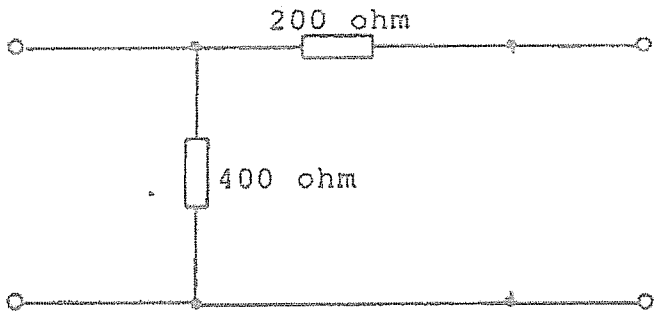

Figure Q3

(b) The parameters of a correctly terminated transmission line are as follows: R=0.5 Ω/m; L=200 nH/m; C=150 pF/m; G=1.2 μs/m; f= 2 MHz. Determine

(i) the characteristic impedance. (3 marks)

(ii) the propagation coefficient. (3 marks)

(iii) the attenuation coefficient. (2 marks)

(iv) the phase shift coefficient. (2 marks)

(c) Define the following terms with respective formulae:

(i) Voltage reflection coefficient (3 marks)

(ii) Voltage standing wave ratio (2 marks)

Question 4

(a) A passive network has the following transmission parameters: A = D = 3, B = 800 Ω.

(i) What is the value of parameter C ?

(3 marks)

(ii) Calculate the input impedance of the network when its output terminals are short-circuited.

(2 marks)

(iii) Calculate the input impedance of the network when its output terminals are open-circuited.

(2 marks)

(iv) Determine the overall transmission parameters when two such networks are cascaded.

(6 marks)

(b) Calculate the transmission parameters of the circuit shown in Figure Q4 shown below. If the output voltage and current are 25V and 16mA, respectively, calculate the input voltage and current.

(12 marks)

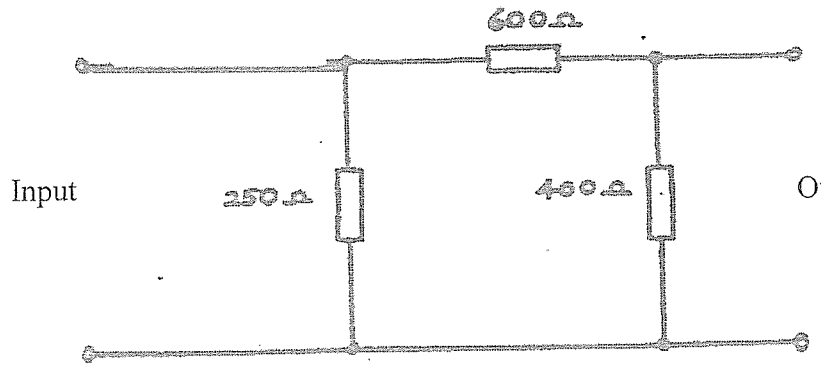

Figure Q4

Question 5

(a) Three impedances coils, each having a resistance of 30 Ω and a reactance of 15 Ω, are connected in star to a 400V, 3 phase, 50 Hz supply. Calculate:

(i) the magnitude of line current
(ii) the power supplied (to the 3 impedances coils)
(iii) the power factor

(6 marks)

(b) Three coils are connected in delta to a 3 phase, 3 wire, 415 V, 50 Hz supply and take a line current of 5 A at 0.8 p.f lagging. Calculate the resistance and inductance of the coils. If the same coils are star-connected to the 3 wire, 415V, 50 Hz supply, calculate the magnitude of line current and the total power delivered.

(12 marks)

(c) Two wattmeters are used for measuring the input power and the power factor of a balanced inductive load. If the readings of the meters are (-2.0 kW) and (+7.0 kW) respectively, calculate the total input power and the power factor of the load.

(7 marks)

Question 6

(a) A transmission line with characteristic impedance of 200 Ω is terminated in a resistive load of 500 Ω. If the voltage measured across the load is 20 V rms. Calculate

(i) the voltage reflection coefficient of the line. (2 marks)
(ii) the incident current and voltage at the load. (6 marks)
(iii) the reflected current and voltage at the load. (4 marks)

(b) A low loss transmission line has characteristic impedance of 500Ω and termination impedance of (300+j200)Ω. What is the voltage standing wave ratio.

(6 marks)

(c) At a frequency of 5 kHz, the input impedance of a transmission line is $2\angle 0°$ kΩ with the terminal open circuited and $450\angle 10°$ Ω with the terminal short circuited. If the propagation coefficient is (0.06 + j0.2)/km, calculate the primary constants R and L of the transmission line.

(7 marks)

--THE END--

EEE1104/(F)/Aug2012/AlanWong/26102012