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

FINAL
Examination Paper

(COVER PAGE)

Session : JAN 2013

Programme : DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

Course : **EEE 1104 ELECTRICAL MEASUREMENTS & TRANSMISSION**

Date of Examination : 8 March 2013

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 Scientific Calculator

Materials provided :

Nil

Examiner(s) : **KEN KONG SENG KUOK**

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: JANUARY 2013 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) What is the difference between absolute instruments and secondary instruments?

(2 marks)

(b) Name the 3 torques acting on the instrument analogue moving system.

(3 marks)

(c) 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 maximum deflection?

(6 marks)

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

(6 marks)

(e) The moving coil galvanometer in part (d) has an internal inductance of 1 mH.

i. How to modify the external circuit arrangement further to measure the same voltage ranges in part (d) for A.C.?

ii. What is needed to be done to enable the galvanometer to measure 2A and 10A A.C. current?

(8 marks)

Question 2

(a) A 415 V, 3-phase, 50 Hz source supplies energy to the following delta connected loads:

- A 180 kW 3-phase induction motor operating at 90% efficiency and 0.8 power factor lagging
- A 50 kW resistive load
- A combination of balanced loads totaling 60 kW at 0.7 power factor leading

Determine the total active, reactive and apparent power consumed.

(10 marks)

(b) A 3-phase, 415 V, 50 Hz supply is applied to a star connected balanced load $2 + j8\ \Omega$ per phase. Two wattmeters method are used to measure the power consumed. Calculate the readings recorded on each of the wattmeter.

(5 marks)

(c) A balanced 3-phase, star connected load of 200 kW takes a leading current of 150 A with a line voltage of 1100 V, 50 Hz. Find the circuit parameters of the load per phase.

(4 marks)

(d) The balanced 3-phase system in part (c) experienced a situation. Phase B supplied a reduced voltage of 500 V while phase C is cut-off. Express the load side voltages in equivalent symmetrical sequence components.

(6 marks)

Question 3

(a) A transmission line is 20 km in length. When a voltage of 12 V at 4000 Hz is applied to the sending end terminals of the line, a voltage of 2 V lagging by 300° appears across the matched load. Calculate the following

i. The attenuation per kilometer
ii. Phase shift coefficient per kilometer
iii. The wavelength
iv. Velocity of propagation

(8 marks)

(b) A line has a characteristic impedance of $200 + j250\ \Omega$ and is terminated in a load of 300 Ω. Calculate the current and voltage reflection coefficients.

(4 marks)

(c) Design an L matching network for the line in part (b) such that the voltage reflection coefficient is reduced to minimum.

(8 marks)

(d) At a particular frequency a transmission line is $\lambda/2$ long and has an attenuation of 3 dB. The characteristic impedance of the line is 600 Ω. A voltage source of 60 V with internal impedance of 600 Ω is connected across the input terminals of the line. Calculate the sending end voltage and the voltage across the 300 Ω load.

(5 marks)

Question 4

(a) For the circuit shown below, calculate

i. The iterative impedance
ii. The image impedance
iii. The insertion loss when it is connected between its image impedances

(12 marks)

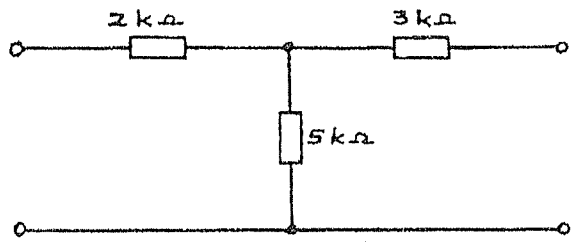

Figure Q4(a)

(b) A 4-terminal resistive network has the following measurements taken:

Input resistance when the output terminals are open-circuited = 1,200 Ω.
Input resistance when the output terminals are short-circuited = 480 Ω.
Output resistance when the input terminals are short -circuited = 560 Ω.

Determine the component values of the equivalent T-network.

(6 marks)

(c) A 50 V A.C. source is applied on a π-network which has a series impedance of 25 Ω and shunt admittances of 20 mS each. If two of such network are cascaded and then terminated with a load resistance of 1200 Ω. Calculate the attenuation of network in Neper.

(7 marks)

Question 5

(a) The coil of a moving-coil voltmeter is 50 mm × 20 mm wide and has 80 turns wound on it. The control spring exerts a torque of 0.15×10^{-3} Nm when the deflection is 50 divisions on the scale. If the flux density of the magnetic field in the air gap is 1 Wb/m^2, estimate the resistance that must be in series with the coil in order to give 1 volt per division. Resistance of the voltmeter is 12,000Ω.

(8 marks)

(b) The operating coil of a 100 V moving iron voltmeter has resistance of 50 Ω and an inductance of 2H. An external resistance of 2,000 Ω is connected in series with the instrument. The instrument reads correctly when a D.C. voltage of 100 V is applied.

i. What will the instrument read when 50 V at 50 Hz is applied?

ii. If a technician decides to replace the external resistor with an inductor so as to give a correct reading of 100 V at 50 Hz, determine the value of the inductor required.

(8 marks)

(c) Ammeters are capable to measure voltage with certain modifications. If a milli-ammeter gives a full scale deflection with 20 mA of current and has coil resistance of 15 Ω, show with circuit diagram how it can be converted to measure the different ranges as below in full scale, i.e. the meter reaches full scale as it measure the maximum value.

i. 0 ~ 5 V

ii. 0 ~ 25 V

iii. 0 ~ 66.7 V

iv. Current up to 2 A.

(9 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

ii. the incident current and voltage at the load

iii. the reflected current and voltage at the load.

(9 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. (4 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.

(6 marks)

(d) A 50Ω coaxial line is terminated by an unknown impedance. If a VSWR of 2 is produced with a voltage minimum at a distance of 0.375 λ from the termination, calculate the value of the unknown impedance.

(6 marks)

--THE END--