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

FINAL
Examination Paper

(COVER PAGE)

Session : JAN 2014

Programme : DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

Course : EEE1104: ELECTRICAL MEASUREMENTS AND TRANSMISSION

Date of Examination : 13 March 2014

Time : 8.00am – 10.00am 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) : **Shalyn Lim Sheue Hui**

Moderator : **Alan Wong**

This paper consists of 9 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)

EEE1104: ELECTRICAL MEASUREMENTS AND TRANSMISSION
FINAL EXAMINATION: JAN 2014 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

(a) Explain the essential torques needed in every meter and how these torques are implemented in PMMC instrument.

(6 marks)

(b) The full-scale deflection for a moving coil voltmeter occurs at a current of 6 mA. The coil has 120 turns, effective area of 3.5 cm×3.0 cm and the deflection angle of 114.6°. Given the spring constant is $2.94\times10^{-5}\,Nm/rad$. Calculate the flux density in the air gap.

(6 marks)

(c) A 10 A range electrodynamic ammeter is controlled by a spring having a torsion constant of 10^{-7} Nm per degree. The full deflection is 120°. Calculate the inductance when measuring a current of 10 A. The initial inductance is 2.5 μH and the change of inductance is linear with deflection of the moving coil.

(6 marks)

(d) A moving coil ammeter gives full-scale deflection with 15mA and has resistance of 5Ω. Calculate the shunt resistance required to enable the instrument to measure up 2A. If the shunt is to be made from a strip of material cross section 0.2 mm × 5 mm having a resistivity of $49\times10^{-8}\,\Omega m$. Calculate the length of the material required.

(7 marks)

Question 2

(a) A moving coil of a d.c voltmeter has a resistance of 5 Ω and it gives full scale deflection when a voltage of 75 mV is applied between its terminals. Calculate and draw the circuit to convert it into a multi-range voltmeter of range of (0 – 100), (0 –200) and (0 – 400) volt.

(6 marks)

(b) A moving coil ammeter has a fixed shunt of 0.02Ω with a coil circuit resistance of R=1kΩ and needs potential difference of 0.5V across it for full scale deflection. Calculate :

(i) the total current.

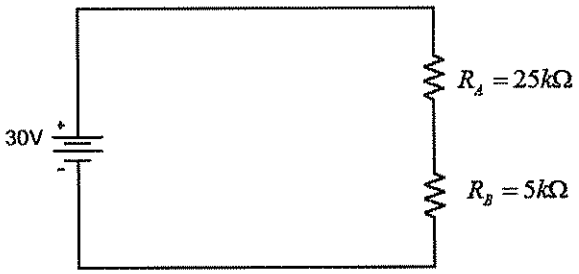
(3 marks)

(ii) the value of the shunt to give full scale deflection when the total current is 10A.

(3 marks)

(c) Refer to Figure Q2(c), the voltmeter range of 10V with sensitivity of 20kΩ/V used to measure the voltage drop across R_B. Calculate the error in voltmeter readings.

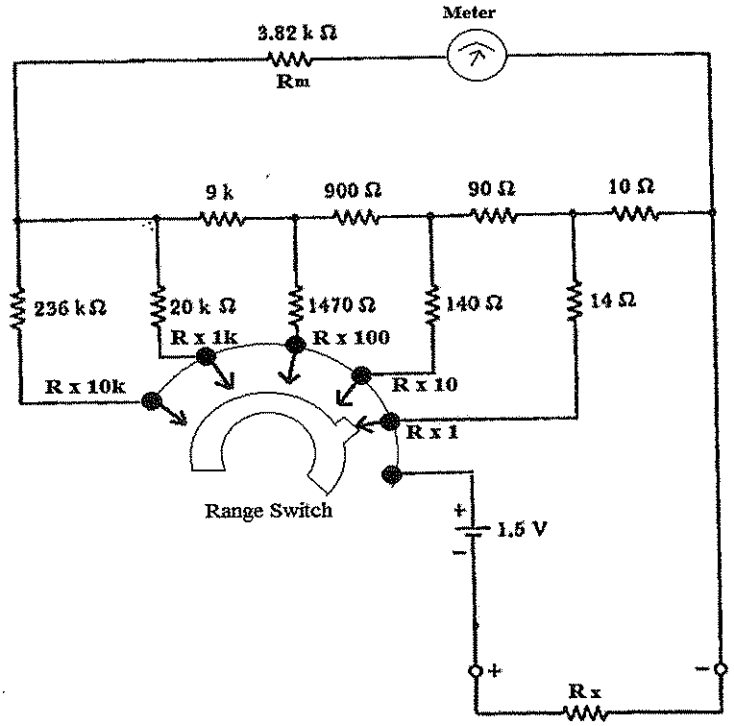
(6 marks)



Q2(c)

(d) Calculate the meter current for the multi range ohmmeter in Figure Q2 (d). Given R_x = 24Ω and the range switch is selected at Rx1.

(7 marks)



Refer to Figure Q2(d)

Question 3

(a) Consider the Y-Y three phase system shown in Figure Q3 (a). Calculate

(i) the line currents for phase **A**.

(4 marks)

(ii) the load phase voltage for phase **A**.

(3 marks)

(iii) the load line voltage, $\mathbf{V_{BC}}$.

(3 marks)

(iv) the load active power per phase.

(3 marks)

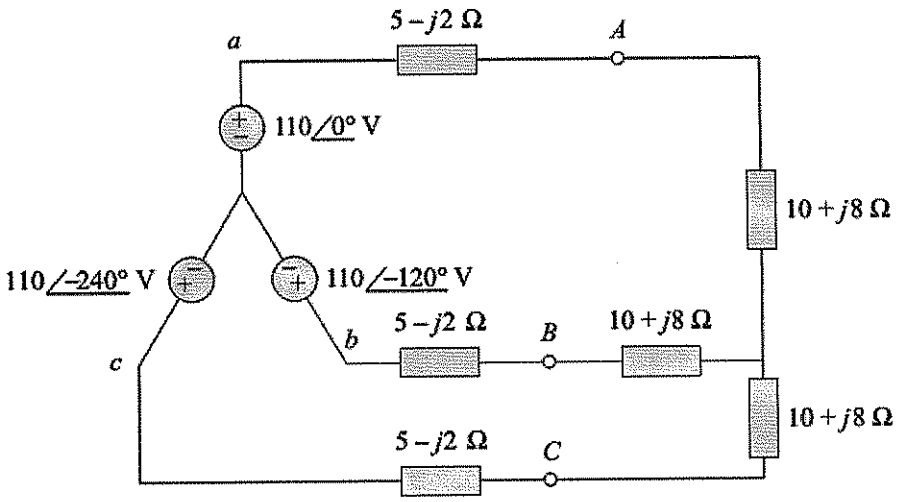


Figure Q3(a)

(b) A balanced delta-connected load is supplied by a 60-Hz three-phase source with a line voltage of 240 V. Each load phase draws 6 kW at a lagging power factor of 0.8. Find:

(i) the load impedance per phase (complex form).

(6 marks)

(ii) the line current (polar form).

(3 marks)

(iii) the value of capacitance needed to be connected in parallel with each load phase to produce unity power factor.

(3 marks)

Question 4

(a) Refer to the two ports network shown in Figure Q4(a). Calculate

(i) Z-parameter.

(5 marks)

(ii) Transmission parameter.

(4 marks)

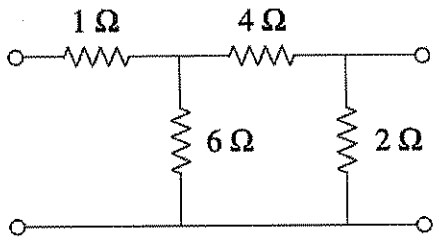


Figure Q4(a)

(b) The network shown in Figure Q4(b)(i) is inserted between the generator and the load resistor shown in Figure Q4(b)(ii). Determine the insertion loss (dB).

(7 marks)

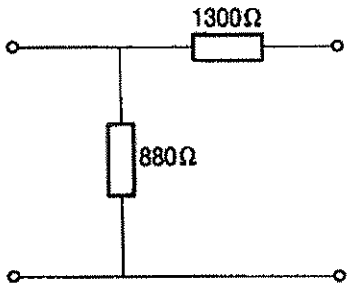


Figure Q4(b)(i)

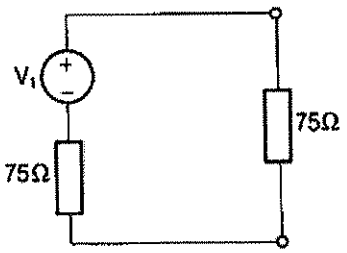


Figure Q4(b)(ii)

(c) Refer to the ABCD network shown in Figure Q4 (c).

(i) Prove that the input impedance , $Z_{in} = \dfrac{AZ_L + B}{CZ_L + D}$.

(5 marks)

(ii) Calculate the image impedance from input terminal if A=D=3 ; B=800Ω and C=10mS.

(4 marks)

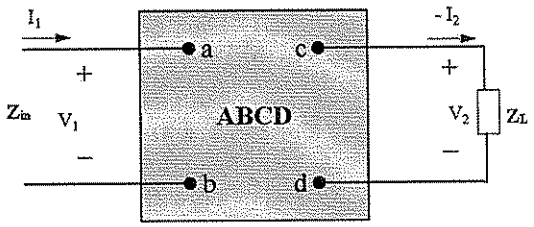


Figure Q4 (c)

Question 5

(a) A high frequency of 100MHz matched transmission line with Z_o=80 Ω and α=20m Np/km has the propagation speed of 1.8×10^8 km/s. consider G is negligible. Calculate

(i) the wavelength.

(2 marks)

(ii) the primary coefficient of R,L and C.

(8 marks)

(iii) the phase delay,β.

(2 marks)

(b) A 16 km length of transmission line has primary coefficient R=22.5 Ω/km, L=175 μH/km, C= 65 nF/km and G ≈ 0 S/km .Given the transmission frequency is 5k Hz, calculate

(i) characteristic impedance.

(3 marks)

(ii) attenuation coefficient and phase-change coefficient.

(6 marks)

(iii) if the line is terminated in its characteristic impedance and supplied by a 400V matched voltage source at a frequency of 5kHz, calculate the current flowing in the load.

(4 marks)

Question 6

(a) Differentiate the effect between extremes termination and characteristic termination.

(3 marks)

(b) A 320km long three-phase line delivers 10MW power at a lagging power factor of 0.8 and line voltage of 120kV to a star load. The ABCD parameters of the line are A=D=0.94+j0.039, B=86.3+j135Ω and C=(-1.48+j8.62)x10^{-5}S. Calculate

(i) the receiving current.

(3 marks)

(ii) sending-end voltage.

(4 marks)

(iii) sending-end current.

(4 marks)

(c) A transmission line has characteristic impedance of 600Ω is terminated in a load of 300 Ω. At a particular frequency the line has attenuation of 3dB and phase shift of 72°. A voltage source of 60*V* and 600Ω impedance is connected across the input terminals of the line. Calculate

(i) the voltage reflection coefficient.

(2 marks)

(ii) the VSWR.

(2 marks)

(iii) the voltage across the load.

(4 marks)

(iv) the reflected voltage across the sending end terminal.

(3 marks)

--THE END--