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

FINAL
Examination Paper

(COVER PAGE)

Session : JANUARY 2012

Programme : DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

Course : EEE1104: ELECTRICAL MEASUREMENTS AND TRANSMISSION

Date of Examination : 8 March 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 Scientific Calculator

Materials provided :
Nil

Examiner(s) : **Shalyn Lim Sheue Hui**

Moderator : **Chan Tse Wei**

This paper consists of _8_ 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: JANUARY 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

(a) Which damping torque method is suitable to be implemented in PMMC instrument? Explain how it works?

(4 marks)

(b) A voltmeter and an ammeter are used to measure resistance with the full scale of 10V and 10A. The readings are 7.20V and 9.05A respectively. The scale of each instrument has 100 division and can be read with certainty to ± 0.5 division and the instrument themselves have an error of ± 1%. Consider the loading effect of both meters is negligible; compute the value of the resistance and the possible absolute error.

(5 marks)

(c) The coil of a moving coil voltmeter is 4cm x 3cm wide and has 100 turns around it. The control spring exerts a torque of 2.4×10^{-4} Nm when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the gap is 1 Tesla, estimate the resistance that must put in series with the coil to give one volt/division. The resistance of the voltmeter coil may be neglected.

(5 marks)

(d) The operating coil of a 250V moving coil voltmeter has a coil resistance of 500 Ω and an inductance of 1H. An external 2kΩ resistor is connected in series with the instrument. The instrument reads correctly when a DC voltage of 250V is applied.

(i) What will the instrument read when 250V at 50Hz is applied.

(4 marks)

(ii) Suggest a method to compensate the frequency error and determine the value of the element used.

(3 marks)

(iii) If the external resistor is being removed and replaced by an inductor, calculate the value of inductor required.

(4 marks)

Question 2

(a) A moving coil ammeter has a fixed shunt of 0.02Ω. With a coil resistance of R=1000Ω and potential difference of 500mV across it, full deflection is obtained.

(i) Calculate the measure current when full deflection is obtained.

(2 marks)

(ii) Determine the value of R as 40% deflection obtained when the current passed through shunt is 100A.

(3 marks)

(b) A technician plans to design a multimeter as shown in Figure Q2(b). The multimeter is required to measure current range of 0-1A, 0-5A and 0-10A; voltage range of 0 – 10V, 0-50V, 0-250V and 0 – 500V.Given the coil resistance R_m =50Ω and full scale deflection current of 1mA. Calculate the suitable values of R_1 ,R_2 ,R_3 ,R_A ,R_B ,R_C and R_D.

(12 marks)

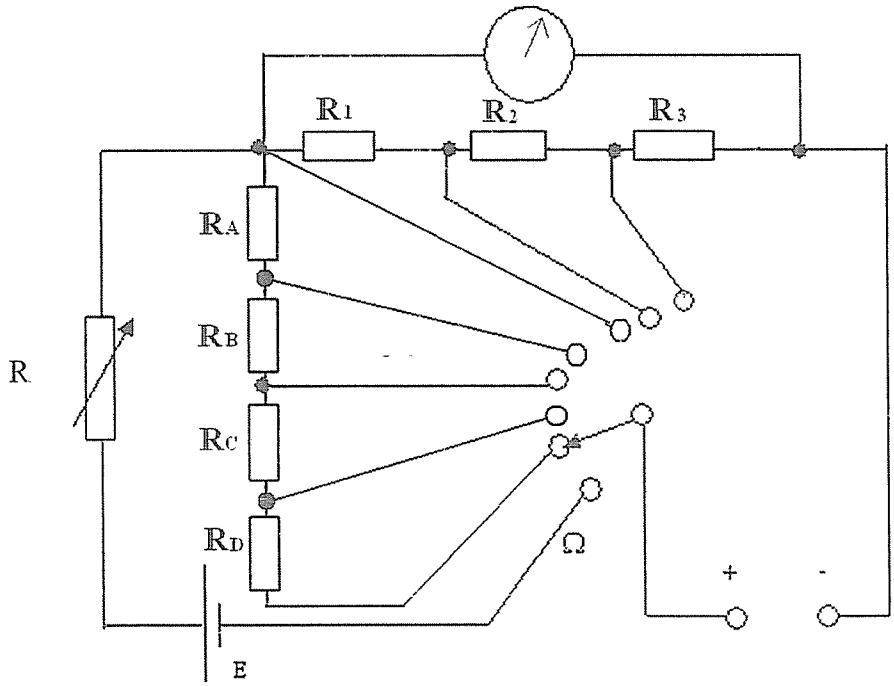

Figure Q2(b)

(c) We desire to measure the voltage across the 10-kΩ resistor as shown in Figure Q2(c). We have two voltmeters, A and B, to measure this voltage. Voltmeter A has a sensitivity of 1 kΩ/V and voltmeter B has a sensitivity of 20 kΩ/V. Both use their 50-V scales. Find the reading and error (in percentage) of each meter. Which voltmeter gives a better result,why?

(8 marks)

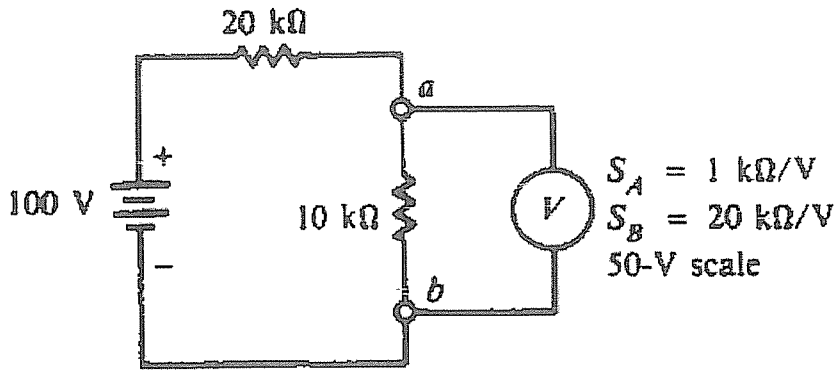

Figure Q2(c)

Question 3

(a) Prove that using Two-Wattmeter method the total active power for balanced three phase loads is given as

$$P_T = \sqrt{3} I_L V_L \cos\theta$$

(5 marks)

(b) A Y load and a delta load are connected in **parallel** as in Figure Q3(b). Line voltage magnitude at the generator is 208 V. Given impedance per- phase of the load are $Z_Y = 20\Omega\angle 0^\circ$ and $Z_\Delta = 90\Omega\angle 0^\circ$ .Assume ABC sequence by taking V_{AN} as reference.

(i) Find the phase voltages at the loads.

(6 marks)

(ii) Find the line voltages at the loads.

(3 marks)

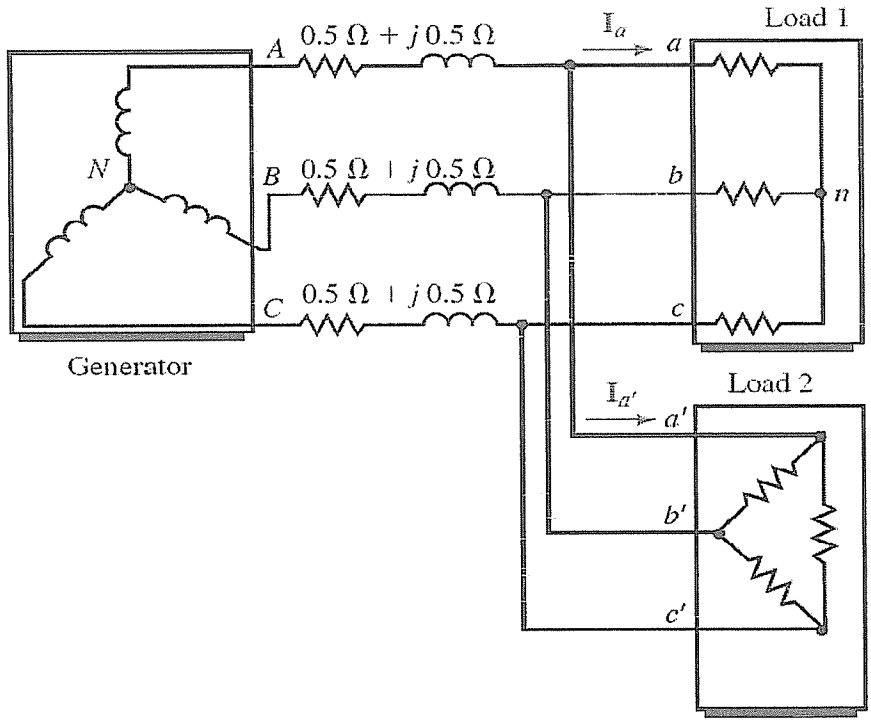

Figure Q3(b)

(c) Each phase of star-connected load consists of a resistance of 100Ω in parallel with a capacitance of 32μF. If this load is connected to a 415V, 3-phase,50 Hz supply, calculate

(i) the power factor

(3 marks)

(ii) total true power

(3 marks)

(d) The phase voltages of a three phase system are $V_A = 100 \angle 0^\circ$, $V_B = 200 \angle -90^\circ$ and $V_c = 100 \angle 120^\circ$ respectively. Calculate the positive, negative and zero phase components of **'B' phase.**

(5 marks)

Question 4

(a) Calculate impedance and admittance parameter of the networks shown in Figure Q4(a)

(7 marks)

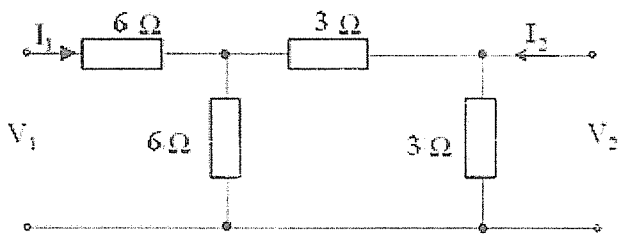

Figure Q4(a)

(b) A T network has series impedance Z_1 =5+j20 Ω and Z_3 =5+j16 Ω, and a shunt impedance Z_2=2-j15 Ω. Calculate

(i) Image impedance

(5 marks)

(ii) Image transfer coefficient

(4 marks)

(iii) Image attenuation coefficient and phase change coefficient.

(3 marks)

(c) Calculate the insertion loss (Np) of the capacitor when connected between 600 Ω and 1200 Ω resistor as Figure Q4(c).

(6 marks)

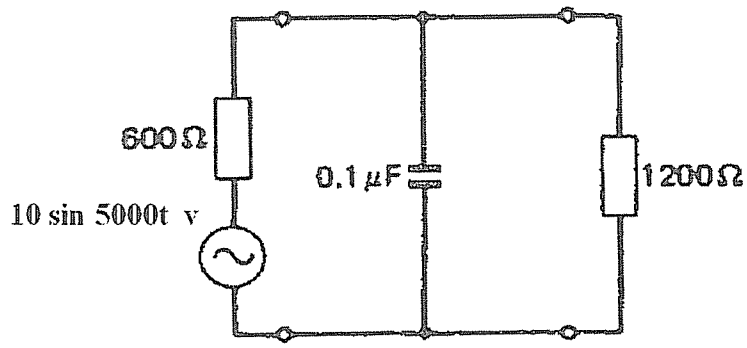

Figure Q4(c)

Question 5

(a) Given a matched transmission line of length 10 km has an input of 10 V r.m.s at 2KHz produces an output across the terminating load of 2V r.m.s lagging by 200^{o}.Calculate the followings:

(i) attenuation coefficient

(3 marks)

(ii) phase-change coefficient

(2 marks)

(iii) velocity of propagation

(2 marks)

(b) A correctly terminated transmission line is 10km long and has the following primary coefficients:

R=20 Ω/km, L=16 mH/km, C= 0.045 μF/km and G ≈ 0 S/km .

Given ω= 5000 rad/s, calculate

(i) the characteristic impedance (polar form)

(3 marks)

(ii) the propagation coefficient (polar form)

(3 marks)

(iii) the attenuation coefficient (dB/km) and phase-change coefficient (degree/km)

(4 marks)

(c) A voltage source of $12\angle 0^{o}$ V and an internal impedance of $500\angle 0^{o}\,\Omega$ is connected across the sending-end terminals of the transmission line given in part (b). Calculate the voltage and current at the load.

(8 marks)

Question 6

(a) Define mismatch on transmission line. What is the effect of mismatch transmission line? With the aid of simple diagrams, describe in words the three conditions for mismatch on transmission line.

(7 marks)

(b) A loss-free line has a characteristic impedance of 1000Ω and a load impedance of (800-j100)Ω. Calculate the voltage reflection coefficient and the v.s.w.r.

(4 marks)

(c) A 320 km long three-phase line delivers 10MW power at lagging power factor of 0.8 and 120kV to a load. The ABCD parameters of the line are A=D=0.94j0.039, B=86.3+j135.1Ω, C= $(-1.48+j8.62)\times10^{-5}$ S. calculate sending-end voltage and current.

(8 marks)

(d) At a frequency of 5 kHz, the input impedance of a transmission line is $2\angle0^{o}\,k\Omega$ with the terminal open circuited and $450\angle10^{o}\,\Omega$ with the terminal short circuited. If the propagation coefficient is (0.06+j0.2)/km, calculate the primary constant for R and L of the transmission line.

(6 marks)

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