MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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THIRD SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATION

EEE204: CIRCUIT THEORY II

DATE: **TIME:**

INSTRUCTIONS:
This paper consists of FIVE questions. Answer Question ONE and any other TWO questions

QUESTION ONE (COMPULSORY-30 marks)

a)(i)State **three** reasons why three phase systems are preferred over single phase systems for transmission of power

(ii)Explain the following as applied to three phase systems

I. Balanced load
II. Phase sequence

(5 marks)

(b)(i)Explain the **need for** unity power factor in industrial loads
(ii)State **two approaches** of improving power factor in the industrial loads

(6 marks)

(c) (i)Two sources of emf $200\sin\omega t$ and $200\sin\omega t + \pi/2)$are in series.

I. Express the resultant nvector in vector notation withn reference to $200\sin\omega t$
II. Determine the rms current and power supplied to (8+j6)Ω impedance

(ii)For the circuit in **Figure 1**, determine the

I. Real power

II. Reactive power
III. Apparent power

(13 marks)

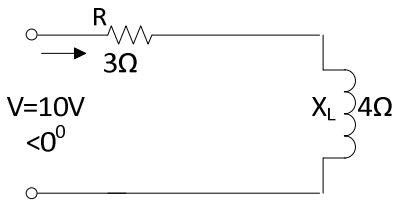

Figure 1

(c)Explain the **dot rule** in coupled circuits

(2 marks)

(d)Distinguish between the **transient** and **steady state** condition of a circuit. Explain why it's important to have knowledge of the two states for a given circuit.

(4 marks)

QUESTION TWO (20 Marks)

(a) For the schematic diagram of the system in Figure 2,

(i)Determine the

I. total number of watts
II. total number of volt-ampere reactive
III. total number of volt-amperes
IV. power factor, PF

(ii)Draw the power triangle

(iii)Find the current in phasor form

(10 marks)

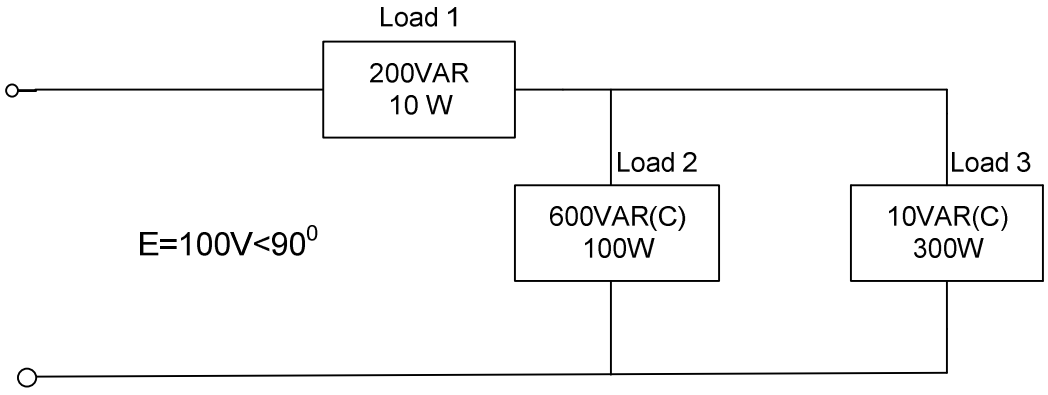

Figure 2

(b) Calculate the phasor currents I_1 and I_2 in the circuit of Figure 1 (10 marks)

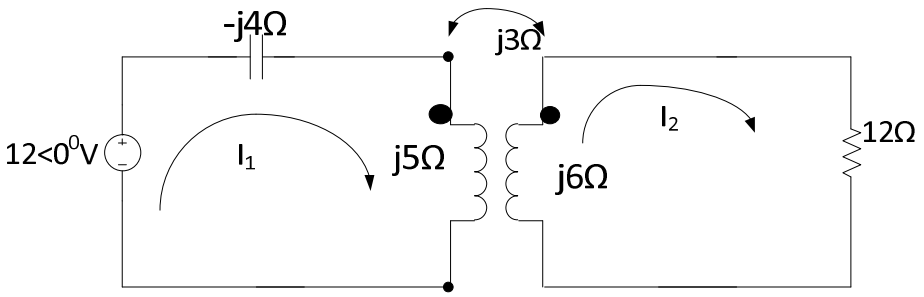

Figure 3

QUESTION THREE (20 MARKS)

(a) When connected to a 120-V(rms), 60 Hz power line, a load absorbs 4kW at lagging power factor 0f 0.8. Determine the value of capacitance necessary to raise the power factor to 0.95. (8 marks)

(b)For a line voltage $V_L = 208\,V$ and wattmeter reading of a balanced system are found to be $P_1 = -560\,W$ and $P_2 = 800W$, determine the :

i. Total average power
ii. Total reactive power
iii. Power factor
iv. Phase impedance

(12 marks)

QUESTION FOUR (20 MARKS)

(a)A 400 V 3 phase 50 Hz system supplies the following three loads: 200 h.p (1 h.p=735.5 W), induction motor operating at 0.9 efficiency and 0.8 lagging power factor, a 50 kW resistance heating load and ba special load of 40kW at 0.707 p.f lagging. Determine the:

i. Total active power
ii. Total reactive power
iii. Total voltamperes
iv. Line current
v. Overall power factor

(b)Find the resonance frequency of the circuit in Figure 7 (10 marks)

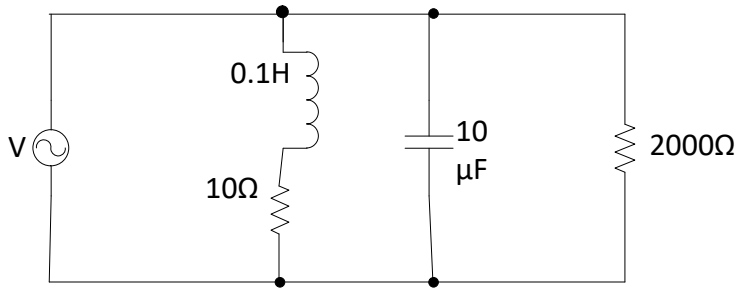

Figure 4

QUESTION FIVE (20 MARKS)

a) A series resonant circuit has the parameters$R = 2\Omega$, $X_L = 10\Omega$, $X_C = 10\Omega$ and source voltage $E = 10V < 0^0$. At resonance, determine the :

i. Circuit current I, voltage across the resistor, inductor and capacitance V_R, $V_{L,}$and V_R respectively;
ii. Quality factor at resonance, Q_s;
iii. Bandwidth if the resonance frequency is 5000Hz;
iv. Power dissipated in the circuit at half power frequencies.

(10 marks)

(b)A 3-phase balanced star connected load has impedance 20+j30 Ω in each phase. It is fed by a 400V 3 phase supply. Determine the:

I. Line current
II. Power factor
III. active power,
IV. reactive power
V. apparent power

(10 marks)