MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 204: CIRCUIT THEORY II

DATE: 20/5/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

Answer Question ONE and any other TWO Questions.

Show calculations where applicable

QUESTION ONE (30 MARKS) (COMPULSORY)

a) Find the forced response for the voltage (v_f) in Fig.Q1a). when $R = 5\ k\Omega$, $C = 100\,\mu F$ and $i = 2t$ mA . (6 marks)

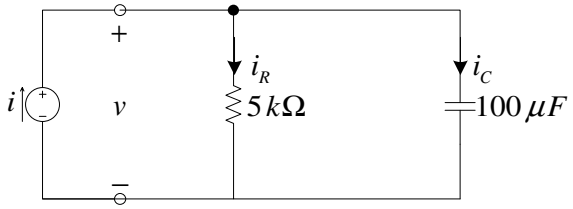

Fig. Q1a)

b) Find the natural response of $v(t)$ for $t > 0$ for the parallel RLC circuit shown in Fig.Q1 b) given that $v(0) = 10$V and $i(0) = 2$ A . (8 marks)

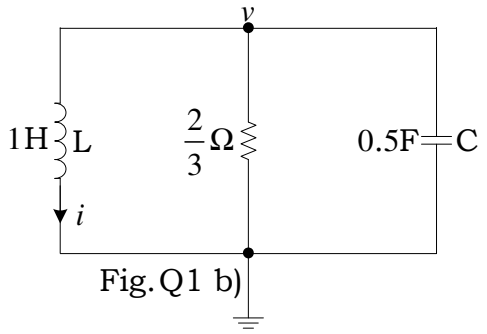

Fig. Q1 b)

c) A parallel circuit with quality factor 120 has a resonance frequency of $6\times10^6\,\text{rad/s}$. Calculate the bandwidth and half-power frequencies. (6 marks)

d) Find $i(t)$ for the circuit shown in Fig. Q1 d) when $v_c(0)=10\text{V}$ and $i(0)=0$ using Laplace transform method. (10 marks)

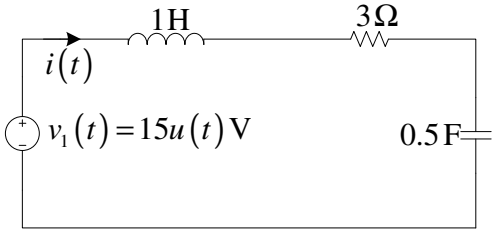

Fig. Q1 d)

QUESTION TWO (20 MARKS)

a) A delta connected three phase load has a resistance of 15Ω and an inductive reactance of 30Ω in each phase. It is fed from a 400V 3 phase balanced supply. Find

i. the line current

ii. total amperes

iii. active power

iv. reactive power

v. Draw phasor diagram showing phase voltages, line voltages and currents.

(14 marks)

b) A series-connected circuit has $R=4\Omega$ and $L=25mH$.

i. Calculate the value of C that will produce a quality factor of 50

ii. Find $\omega_1, \omega_2, and\, BW$ (6 marks)

QUESTION THREE (20 MARKS)

a) In the circuit shown below, find

i. The total circuit impedance

ii. The current supplied by the source

iii. The apparent power of the circuit

iv. The active power of the circuit (10 marks)

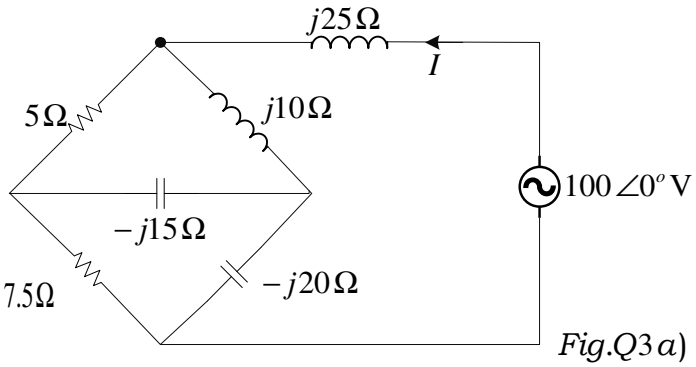

Fig.Q3 a)

b) The input to the circuit shown in Fig.Q3 b) is the source voltage v_s, and the response is the mesh current i. What are the values of the gain and phase shift when the input frequency is $\omega = 20$ rad/s ? (5 marks)

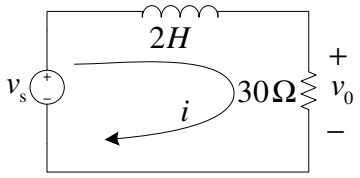

Fig. Q3 b)

c) Obtain the Bode plot of the input impedance of the network shown in Fig. Q3 c). (5 marks)

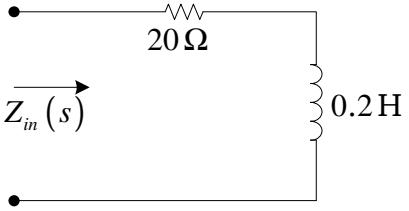

Fig. Q3 c)

QUESTION FOUR (20 MARKS)

a) For the circuit shown in Fig. Q4 a), find the complete response of the circuit given that $i(t) = 0$ for $t < 0$ and that $v(t) = 200\sin 240t$ V for $t > 0$. (12 marks)

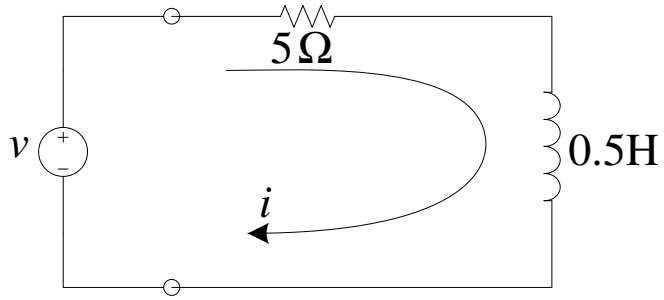

Fig.Q4 a)

b) Find v_{in}, i_1, and i_2 in Fig. Q4 b) under dc steady-state conditions with $i_{in} = 2$ A. Then calculate the total stored energy when $L = 5$ mH and $C = 25\,\mu$F. (5 marks)

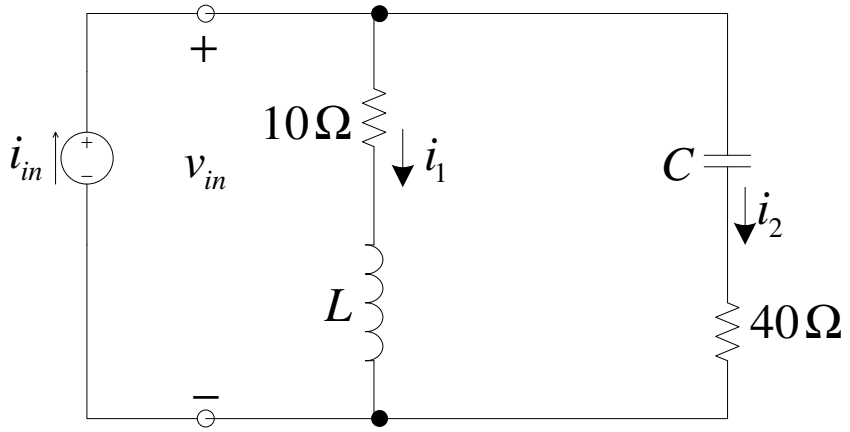

Fig. Q4 b)

c) Explain the following terms as used in circuit theory:

i. Natural response

ii. Dynamic circuit (3 marks)

QUESTION FIVE (20 MARKS)

a) Using Fourier transform, determine and plot the spectrum of the response $V_0(\omega)$ of the circuit of Fig.Q5 a) when $v(t) = 10e^{-2t}u(t)\,\text{V}$

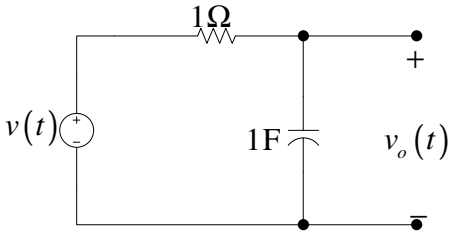

Fig. Q5 a)

(8 marks)

b) A 3 phase balanced star connected load is connected to a 240 V 3 phase supply. The total volt amperes are 6000 VA and total active power is 4800 W. Find

i. Power factor

ii. Line current

iii. Phase current

iv. Resistance and reactance of load in each phase (6 marks)

c) It is expected that a parallel resonant circuit has a mid-band admittance of $25\times10^{3}\,\text{S}$, quality factor of 80, and a resonant frequency of $200\,krad/s$. Calculate the value of R, L, and C. Find the bandwidth and the half-power frequencies. (6 marks)