



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

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: 14/12/2020

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

Show calculations where applicable

QUESTION ONE (COMPULSORY)(30 MARKS)

- a) In an RLC series circuit shown in Fig. Q1 a) determine
- Maximum power dissipated in the circuit
 - The bandwidth of the resonant circuit
 - The half-power frequencies ω_1 and ω_2
 - The circuit current at half-power frequency
 - The power dissipated at the lower half-power frequency, ω_1
- (14 marks)

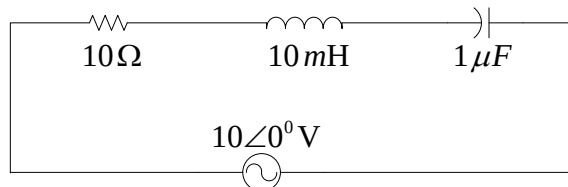


Fig. Q1 a)

- b) Find the forced response for the voltage in Fig. Q1 b). when $R = 2.5 \text{ k}\Omega$, $C = 100 \mu\text{F}$ and $i = 6t \text{ mA}$. (7 marks)

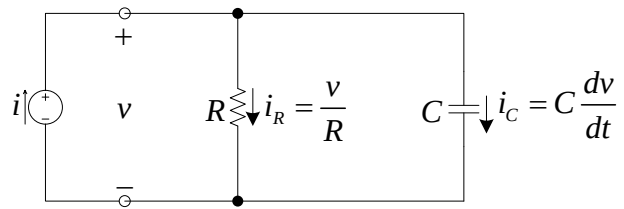


Fig. Q1 b)

- c) Explain the following terms as used in circuits:
- Quality factor, Q
 - Resonance
- (3 marks)
- d) Find $f(t)$ of the following function (6 marks)

$$F(s) = \frac{15s^2 - 16s - 7}{(s+2)(s^2 + 6s + 25)}$$

QUESTION TWO (20 MARKS)

- a) For the circuit of Fig.Q1 a), obtain the gain $I_o(\omega)/I_i(\omega)$ and its poles and zeros. (6 marks)

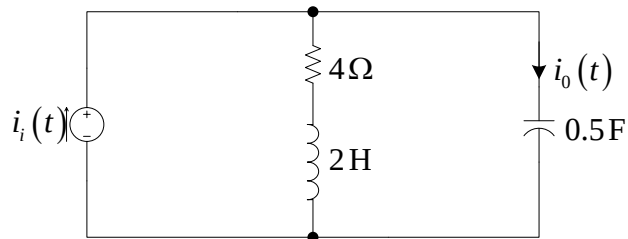


Fig. Q1 a)

- b) A balanced delta connected load of $(12 + j5)\Omega$ is fed from a 3 phase 3 wire 130 V system. Find
- The magnitude of phase and line currents and
 - Total active power
- (8 marks)
- c) Briefly explain three advantages of three-phase circuit over single-phase circuit. (6 marks)

QUESTION THREE (20 MARKS)

- a) In the parallel RLC circuit shown in Fig. Q 3 a)
- Calculate the values of ω_0 , Q-factor, and Bandwidth
 - Find half-power frequencies, ω_1 and ω_2
 - Determine the power dissipated at ω_0 , ω_1 and ω_2 .
- (9 marks)

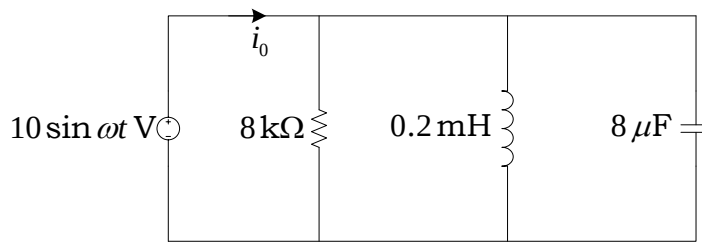


Fig. Q3 a)

- b) Construct the Bode plots for the following transfer function

$$H(s) = \frac{20(s+2)}{s(s^2+4s+16)}$$

(6 marks)

- c) A 3-H inductor and a $20\mu\text{F}$ capacitor are in series with an unknown inductor. If the voltage across the capacitor is $v_c = 5\sin 100t$ and the total voltage across the network is equals zero, then what is the value of the unknown inductance L_x ?
- (5 marks)

QUESTION FOUR (20 MARKS)

- a) Find $v_2(t)$ for $t > 0$ using state variable method for the circuit shown in Fig. Q4 a), assume there is no initial stored energy.
- (10 marks)

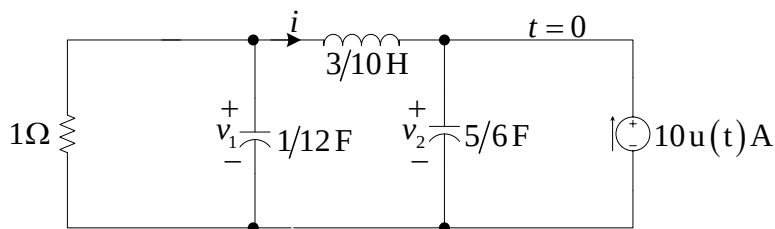


Fig. Q4 a)

- b) Find $i(t)$ for the circuit shown in Fig. Q4 b) using Laplace transform method when $v_c(0) = 10\text{V}$ and $i(0) = 0$. The input source is $v_1(t) = 15u(t)\text{V}$. (10 marks)

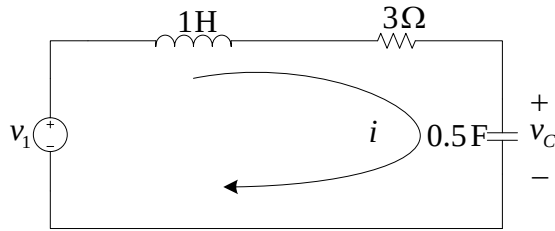


Fig. Q4 b)

QUESTION FIVE (20 MARKS)

- a) Find the response, $v_o(t)$ of the RL circuit of Fig. Q5 a) when $v(t) = 4e^{-2t}u(t)\text{V}$. The initial condition is zero. (5 marks)

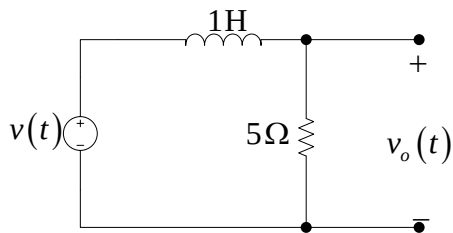


Fig. Q5 a)

- b) A star connected three phase load has a resistance of 8Ω and a capacitive reactance of 10Ω in each phase. It is fed from a 400V 3 phase balanced supply. Find
- The line current
 - Total amperes
 - Active power
 - reactive power
 - Draw phasor diagram showing phase voltages, line voltages and currents. (15 marks)