



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 204: CIRCUIT THEORY II

DATE:

TIME: 2 HOURS

INSTRUCTIONS TO STUDENTS

1. This paper contains 5 questions.
2. Attempt **Question One** and **Any Other Two** questions
3. Show calculations where applicable

QUESTION ONE (30 MARKS) (COMPULSORY)

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

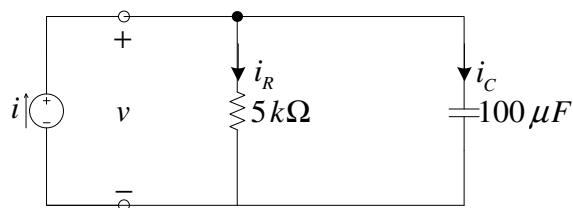
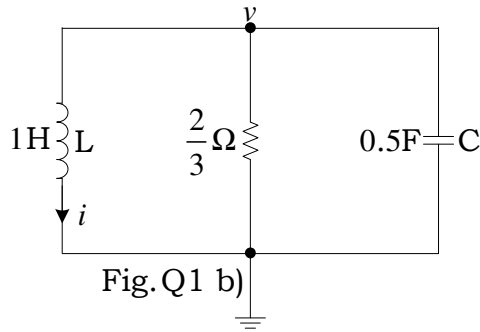
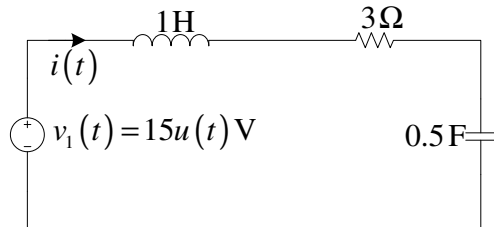


Fig. Q1a)

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



- c) A parallel circuit with quality factor 120 has a resonance frequency of 6×10^6 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]



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
- the line current
 - total amperes
 - active power
 - reactive power
 - Draw phasor diagram showing phase voltages, line voltages and currents.
- [14 marks]
- b) A series-connected circuit has $R = 4\Omega$ and $L = 25\text{mH}$.
- Calculate the value of C that will produce a quality factor of 50

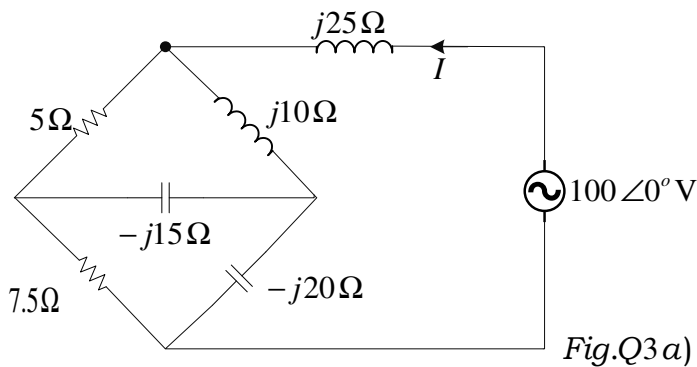
(ii) Find ω_1, ω_2 , and BW

[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]



- a) A 3 phase balanced star connected load is connected to a 220 V, 3 phase supply. The total volt amperes are 5000 VA and total active power is 4800 W. Find
- (i) Power factor
 - (ii) Line current
 - (iii) Phase current

Resistance and reactance of load in each phase

[10 marks]

QUESTION FOUR [20 MARKS]

- a) A star connected three phase load has a resistance of 10Ω and a capacitive reactance of 15Ω in each phase. It is fed from a 440V 3 phase balanced supply.

- (i) Find the line current, total amperes, active and reactive power.
- (ii) Draw phasor diagram showing phase voltages, line voltages and currents.

[14 marks]

- b) The inductance of an inductor depends on four factors. State the four factors

[4 marks]

- c) Two coils each having an inductance of $300\mu\text{H}$ have combined inductance of $550\mu\text{H}$ when connected series-aiding and $500\mu\text{H}$ when connected series-opposing. Calculate

- (i) their mutual inductance, and
- (ii) Coefficient of coupling.

[2 marks]

QUESTION FIVE [20 MARKS]

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

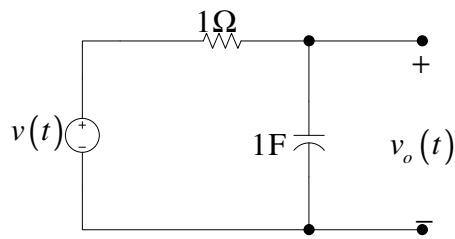


Fig. Q5 a)

[8 marks]

- b) Determine the forced response for the circuit current, i_f , for the circuit of Fig. Q5 b) when $v_s = 0.2t$ V.

[6 marks]

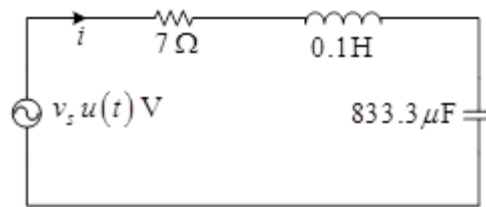


Fig. Q5 b)

- c) It is expected that a parallel resonant circuit has a mid-band admittance of 25×10^3 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]