

OLUSEGUN AGAGU UNIVERSITY OF SCIENCE AND TECHNOLOGY (OASTECH), ORISHIPUPA.
 SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
 2019/2020 SESSION FIRST SEMESTER EXAM (COURSE CODE: EEE 303)
 COURSE TITLE: CIRCUIT THEORY I; TIME ALLOWED: 3 HOURS CREDIT: 3 UNIT; INSTRUCTION:
 ANSWER QUESTION ONE (I) & ANY OTHER THREE (3) QUESTIONS

QUESTION 1: COMPULSORY

- Derive from the first principles the current growth in an inductive circuit (5 marks)
- An $8 \mu\text{F}$ Capacitor is connected in series with a $0.5 \text{ m}\Omega$ resistor across a 200 V . Calculate
 - The time constant
 - The initial charging current
 - The time taking for potential difference across capacitor to growth to 160 V
 - The current and the potential difference across the capacitor 4s after connected to the supply 128 V . (10 marks)
- A coil having a resistance of 4Ω and a constant inductance of 2 H is switch across a 200 V supply calculate
 - The time constant
 - The final value of the current
 - The value of the current 1 second after the switch is closed.

QUESTION 2

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- In a series RLC circuit $R = 200\Omega$, $L = 0.1 \text{ H}$. Find the value of C required to make the system critical damped. (5 marks)
- The contact of a circuit breaker were opened by a means of trip coil connected to 110 Volt coil 1 second after it was switched to ON was given by $i(t) = V/R (1 - e^{-Rt/L})$. The circuit breaker contact start to open when resistance of the trip coil 2.2 H and 440Ω . Determine
 - The final steady value of the current
 - The time constant
 - The energy stored under final steady condition
 - The value of current at the instant when the circuit start to open $t = 0.01\text{s}$
 - The time taken for current to grow from 0 to 0.2 A
 - The initial rate of change of current

QUESTION 3

- The voltages and currents in electric circuits are described by three classes of time function. name the classes and define each. (5 marks)
- An appliance uses $V_{\text{eff}} = 120 \text{ V}$ at 60 Hz and draws $I_{\text{eff}} = 10 \text{ A}$ with a phase lag of 60° . Express v , i , and $p = vi$ as functions of time and show that power is periodic with a dc value. Find the frequency, and the average, maximum, and minimum values of p . (5 marks)
- Find the average and effective value of the half-rectified cosine wave $v_1(t)$ shown in Fig. Q3b (5 marks)

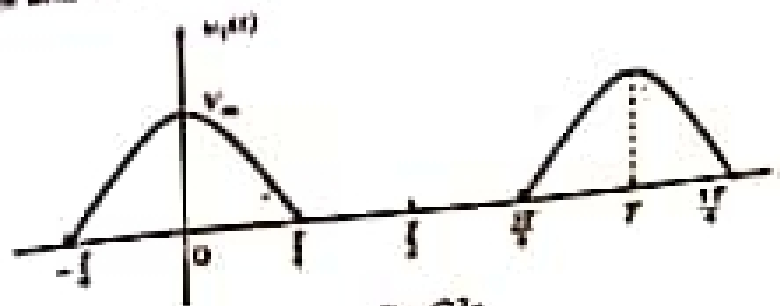


Fig. Q3c

QUESTION 4

- Derive from the first principles the RLC series circuit expression for over-damped, critically damped, or underdamped when $t = 0$ (7 marks)
- A series RLC circuit, with $R = 3\text{k}\Omega$, $L = 10 \text{ H}$, and $C = 200 \mu\text{F}$, has a constant-voltage source, $V = 50 \text{ V}$, applied at $t = 0$. Find
 - Obtain the current transient, if the capacitor has no initial charge. (8 marks)
 - Sketch the current and find the time at which it is a maximum.