

ELT141 Circuits I ACAD 08-006 Verification Exam:

Relevant Objectives from ACAD 08-006 for ELT141:

ACAD 1.1.1:

3. Perform basic calculations that involve significant figures including measurement
5. Apply scientific and engineering notation in calculations including conversion of numbers [Gap 43]

ACAD 1.1.3 [Gap 91 – 106]

1. Apply direct current (DC) concepts and laws; perform calculations and measurements including the following:
 - basic electrical circuits such as series and parallel, series-parallel combinations
 - conductors and insulators
 - direct current (DC) theory and DC sources (such as ideal voltage and current, non-ideal voltage and current)
 - electrical laws (such as Ohm's law, Kirchhoff's voltage and current laws)
 - electron theory
 - units of electrical measurement (such as ohms, volts, amps, watts, coulombs, joules)
 - voltage, current, resistance and power
2. Apply alternating current (AC) concepts and laws and perform calculations and measurements including the following:
 - alternating current (AC) theory and AC sources (such as ideal voltage and current, non-ideal voltage and current)
 - basic electrical circuits such as series and parallel
 - units of electrical measurement (such as henries, farads, reactance, impedance)
 - passive components, capacitors, inductors
 - ~~- single phase versus three phase~~
 - voltage, current, impedance, real, reactive, apparent power and power factor relationships

ACAD 5.1.1.2

1. Electrical maintenance and I&C students explain the following topics:
 - circuit breakers and fuses [Gap 2304]
 - construction of conductors and insulators (such as examples of various cables, shielding and failure mechanisms) [Gap 2305]
 - electron theory [Gap 2306]
 - inductance, capacitance, impedance, resonance and reactance [Gap 2307]
 - magnetism (such as Faraday's Law of Induction, Lenz's Law, amp-turns, volt-turns, B&H fields) [Gap 2309]
 - ~~- relays [Gap 2310]~~
 - series, parallel and combination circuits applied to AC and DC circuits [2311]
 - Thevenin's and Norton's theorems [Gap 2312]
 - theory of operation of plant electrical components
 - transformers
 - * types, functions and operation [Gap 2317]

NOTE: Items that are marked with a strikethrough symbol are covered in other courses in the program.

Exam Rules:

- 1) Access to the internet is prohibited.
- 2) Cell phones are not allowed to be used in the exam room.
- 3) 3 hours maximum.
- 4) All scrap paper must be included with the exam.
- 5) No notes may be taken into or removed from the exam room.

Student Acknowledgement:

I understand that my score on this exam will be used as a measure of my skills in the objectives above and that these skills will be re-measured to assure that a mastery level of 80% is verified.

Student Signature & Date: _____

ELT-141 Final Exam Formula Sheet

$$V = I R$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

$$P = V I$$

$$P = \frac{V^2}{R}$$

$$P = I^2 R$$

$$R_S = R_1 + R_2 + \dots + R_N$$

$$R_P = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_N}}$$

$$V_X = V_S \frac{R_X}{R_S}$$

$$I_X = I_S \frac{R_P}{R_X}$$

$$V_{Sec} = V_{Pri} \frac{N_{Sec}}{N_{Pri}}$$

$$I_{Pri} = I_{Sec} \frac{N_{Sec}}{N_{Pri}}$$

$$C_S = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_N}}$$

$$C_P = C_1 + C_2 + \dots + C_N$$

$$L_S = L_1 + L_2 + \dots + L_N$$

$$L_P = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \dots + \frac{1}{L_N}}$$

$$\tau = R C$$

$$\tau = \frac{L}{R}$$

$$X_L = 2 \pi f L / 90^\circ$$

$$X_C = \frac{1}{2 \pi f C} / -90^\circ$$

$$f_C = \frac{1}{2 \pi R C}$$

$$f_C = \frac{R}{2 \pi L}$$

$$f_r = \frac{1}{2 \pi \sqrt{L C}}$$

BAND TYPE	COLOR	DIGIT VALUE	MULTIPLIER VALUE	TOLERANCE VALUE
Digit/Multiplier Bands	Black	0	10 ⁰	—
	Brown	1	10 ¹	—
	Red	2	10 ²	±2%
	Orange	3	10 ³	—
	Yellow	4	10 ⁴	—
	Green	5	10 ⁵	—
	Blue	6	10 ⁶	—
	Violet	7	10 ⁷	—
	Gray	8	—	—
	White	9	—	—
Multiplier/Tolerance Bands	Silver	—	10 ⁻²	±10%
	Gold	—	10 ⁻¹	±5%
	No band	—	—	±20%

Table 2-1. Resistor Color Code for Three- and Four-Band Resistors

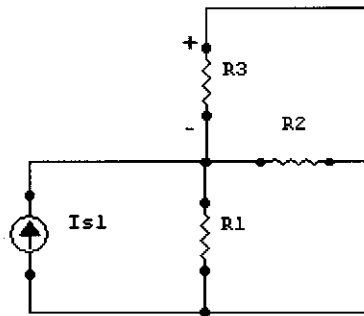
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) A resistor, an inductor, and a capacitor are in parallel across a sine wave ac source. The resistor carries 7 mA, the inductor, 3 mA, and the capacitor, 11 mA. The magnitude of the total circuit current (I_T) is 1) _____
 A) 7 mA B) 14 mA C) 1 mA D) 10.6 mA

- 2) The peak value of a pure sine wave is 2) _____
 A) 1.414 of the peak-to-peak value B) 0.707 of the peak-to-peak value
 C) half its peak-to-peak value D) twice its peak-to-peak value

- 3) The instantaneous value of a sinusoidal waveform can be found by 3) _____
 A) $v = 360^\circ/t$ B) $v = .707 v_{pk}$ C) $v = v_{pk} \sin \theta$ D) $v = 1.414 v_{rms}$

- 4) In the circuit below, I_{s1} is 12 mA, R_1 is 4 k Ω , R_2 is 8 k Ω and R_3 is 8 k Ω . Calculate V_{R_3} (with polarity shown). 4) _____

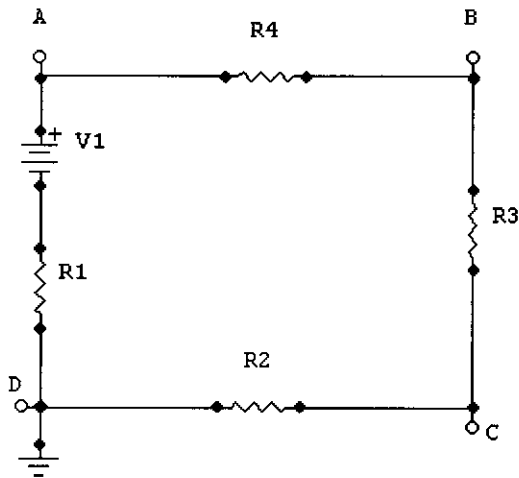


- A) -96 V B) 24 V C) -24 V D) 96 V

- 5) A voltage source (V_S) with 30 Ω of internal resistance (R_S) has a no-load output of 15 V. The voltage across the load (V_L) when the load resistor (R_L) is 1 k Ω is 5) _____
 A) 436.9 mV B) 15 V C) 14.56 V D) 0 V

6) In the circuit below, V_1 is 2 V, R_1 is 2 k Ω , R_2 is 3 k Ω , R_3 is 4 k Ω and R_4 is 1 k Ω . Calculate V_{CB} .

6) _____



A) 800 mV

B) -800 mV

C) -2 mV

D) 2 mV

7) Which of the following statements, relative to inductance, is not true?

7) _____

- A) The relative motion caused by the changing magnetic field induces a voltage across the inductor.
- B) As the magnetic field expands and collapses, it cuts through the stationary inductor. This produces a relative motion between the two.
- C) As the inductor current increases, the magnetic field collapses. As the inductor current decreases, the magnetic field expands.
- D) The current through an inductor generates magnetic flux.

8) A parallel circuit has a value of $R_T = R_1 \parallel R_2 \parallel R_3$. If one resistor opens, R_T

8) _____

- A) decreases
- B) is reduced by one-third
- C) increases
- D) stays the same

9) In an LC circuit, which statement is false?

9) _____

- A) An increase in L causes an increase in f_r .
- B) A decrease in C causes an increase in f_r .
- C) An increase in C causes a decrease in f_r .
- D) An increase in L causes a decrease in f_r .

10) Voltage can be described as

10) _____

- A) a difference in potential
- B) the flow of protons
- C) the flow of electrons
- D) the opposition to current flow

11) Inductive reactance is measured in

11) _____

- A) ohms
- B) henries
- C) farads
- D) None of the above

12) Direct current (DC)

12) _____

- A) may change in magnitude
- B) flows only in one direction
- C) is unidirectional
- D) All of the above

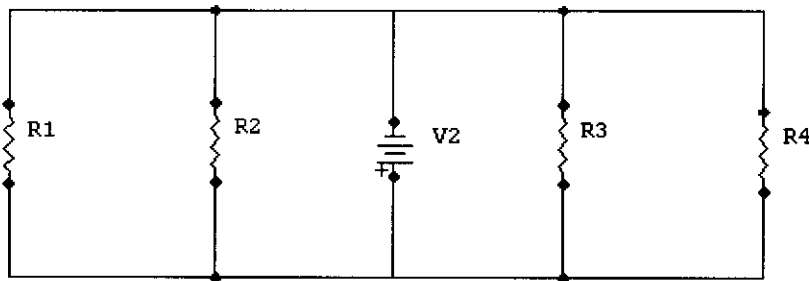
- 13) In order to measure resistance 13) _____
 A) you must touch only one lead of the component
 B) you must disconnect the power
 C) you must connect the meter across the component
 D) All of the above

- 14) Five $10\text{-}\mu\text{F}$ capacitors are connected in series. Total capacitance is 14) _____
 A) $10\ \mu\text{LF}$ B) $25\ \mu\text{F}$ C) $50\ \mu\text{F}$ D) $2\ \mu\text{F}$

- 15) If circuit voltage and resistance are both reduced by the same factor, 15) _____
 A) current is reduced by the same factor
 B) current remains the same
 C) current is increased by the same factor
 D) the effect on current cannot be determined

- 16) When the total voltage in an ideal series LC circuit is represented by $120\ \text{mV} \angle 0^\circ$, we know the circuit 16) _____
 A) is operating at resonance B) is operating above resonance
 C) is operating below resonance D) has no signal applied to it

- 17) In the circuit below, V_2 is $8\ \text{V}$, R_1 is $330\ \Omega$, R_2 is $470\ \Omega$, R_3 is $2.2\ \text{k}\Omega$ and R_4 is $3.3\ \text{k}\Omega$. Calculate the power supplied by V_2 . 17) _____



- A) $378.6\ \text{W}$ B) $-378.6\ \text{mW}$ C) $378.6\ \text{mW}$ D) 378.6

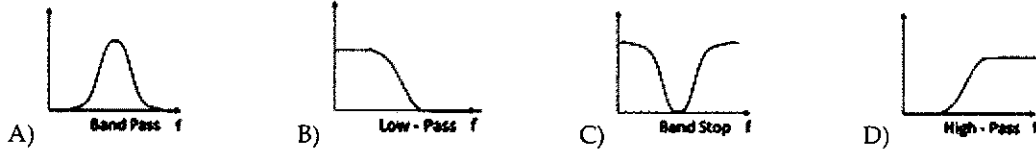
- 18) In an ideal transformer 18) _____
 A) secondary voltage is proportional to primary current
 B) secondary current is always less than or equal to primary current
 C) secondary voltage is always larger than primary voltage
 D) primary power always equals secondary power

- 19) One complete cycle of a waveform occupies 4 major divisions on an oscilloscope display. If the time base is set at $1\ \text{ms/div}$, the frequency of the waveform is 19) _____
 A) $4\ \text{kHz}$ B) $1\ \text{kHz}$ C) $250\ \text{Hz}$ D) $4\ \text{ms}$

- 20) The material with the least resistance is 20) _____
 A) aluminum B) silver C) copper D) tin

- 21) The period of a sine wave with a frequency of $2\ \text{KHz}$ is 21) _____
 A) $500\ \mu\text{s}$ B) $2\ \text{ms}$ C) $500\ \text{ms}$ D) $2\ \mu\text{s}$

22) In a series RLC circuit, the frequency response of V_{LC} would look like 22) _____



23) Which is not a characteristic of an open circuit? 23) _____

- A) The resistance of the open component is too high to measure.
- B) The circuit resistance is very low.
- C) The full-applied voltage is measured across the open.
- D) The circuit current drops to zero.

24) When we say that the current entering a point in a circuit is equal to the sum of the currents leaving the point, we are stating a form of 24) _____

- A) Kirchhoff's voltage law
- B) Newton's law
- C) Ohm's law
- D) Kirchhoff's current law

25) Resistors of $4\text{ k}\Omega$ and $4\text{ k}\Omega$ are connected in parallel across a 15-V source. The total circuit resistance is 25) _____

- A) $4\text{ k}\Omega$
- B) $8\text{ k}\Omega$
- C) $1000\ \Omega$
- D) $2000\ \Omega$

26) The unit of measure for frequency is the 26) _____

- A) hertz
- B) ampere
- C) cycle
- D) period

27) A circuit has a current source of 25 mA and an internal resistance (R_S) of $75\ \Omega$. Calculate the current through the $40\ \Omega$ load resistance (R_L). 27) _____

- A) 38.3 mA
- B) 16.3 mA
- C) 12.6 mA
- D) 25 mA

28) The simple (not vector) sum of capacitor and resistor voltage ($V_C + V_R$) in a series RC circuit is 28) _____

- A) equal to the source voltage (V_S)
- B) less than the source voltage
- C) greater than the source voltage
- D) equal to the apparent voltage

29) Converting $0.1\ \mu\text{F}$ to farads, we get 29) _____

- A) $0.000001\ \text{F}$
- B) $0.0000001\ \text{F}$
- C) $0.01\ \text{F}$
- D) $0.0001\ \text{F}$

30) A capacitor with a reactance (X_C) of $1.2\text{ k}\Omega$ is in series with a $1\text{ k}\Omega$ resistor. The combination is across a sine wave ac source producing 20 mA . The phase angle (θ) of the source voltage, using current as a reference, is 30) _____

- A) 39.8°
- B) -39.8°
- C) 50.2°
- D) -50.2°

- 40) Fuses are typically rated by _____
 A) current and voltage
 B) voltage, alone
 C) power, alone
 D) current, alone
- 41) A circuit that has more than one path for current flow between two points is called a(n) _____
 A) parallel circuit
 B) power circuit
 C) wye circuit
 D) series circuit
- 42) When using series-opposing voltage sources _____
 A) the source voltages tend to aid one another
 B) the total source voltage is equal to the algebraic sum of the individual source voltages
 C) the source currents aid one another
 D) the total source voltage is always zero
- 43) Increasing the value for L , alone, in a series RL circuit causes _____
 A) X_L to increase
 B) V_R to increase
 C) Has no effect on θ
 D) Z_T to decrease
- 44) When a circuit is replaced with a voltage source and an equivalent series resistance, which of the following is being used? _____
 A) Thevenin's theorem
 B) Kirchhoff's Voltage Law
 C) Norton's theorem
 D) Kirchhoff's Current Law
- 45) Which statement is not true with regard to an inductive parallel circuit? _____
 A) The total reactance is always lower than the lowest branch value.
 B) Total inductive reactance is the sum of the individual reactances.
 C) The circuit current equals the sum of the branch currents.
 D) All branch voltages equal the source voltage.
- 46) A capacitor with an X_C of 500Ω is across a sine wave ac source of 10 V . In parallel with the capacitor is a 300Ω resistor. The magnitude of Z_T for the circuit is _____
 A) $\approx 583 \Omega$
 B) $\approx 340 \text{ k}\Omega$
 C) $\approx 150 \text{ k}\Omega$
 D) $\approx 257 \Omega$
- 47) Four resistors are connected in parallel. Which of the following statements is true? _____
 A) R_T is smaller than the smallest resistor
 B) Nothing can be said about R_T from the information given
 C) R_T is somewhere between the smallest and the largest resistors
 D) R_T is larger than the largest resistor
- 48) If one branch fails as an open in a parallel circuit _____
 A) circuit voltage decreases
 B) circuit voltage remains unchanged
 C) circuit voltage increases
 D) circuit voltage drops to zero
- 49) Lenz's law states that _____
 A) the current through an inductor generates magnetic flux
 B) an induced voltage always opposes a change in current
 C) current through a wire produces magnetic lines of force
 D) to induce a voltage across a wire, there must be a relative motion between the wire and the magnetic field

50) In an inductor circuit, voltage

50) _____

- A) lags current by 90°
- C) lags current by 45°

- B) and current are in phase
- D) leads current by 90°

Answer Key

Testname: ELT141PRACTICE_5-27-13

- 1) D
- 2) C
- 3) C
- 4) C
- 5) C
- 6) B
- 7) C
- 8) C
- 9) A
- 10) A
- 11) A
- 12) D
- 13) D
- 14) D
- 15) B
- 16) A
- 17) C
- 18) D
- 19) C
- 20) B
- 21) A
- 22) C
- 23) B
- 24) D
- 25) D
- 26) A
- 27) B
- 28) C
- 29) B
- 30) D
- 31) D
- 32) C
- 33) C
- 34) A
- 35) D
- 36) A
- 37) D
- 38) B
- 39) D
- 40) A
- 41) A
- 42) B
- 43) A
- 44) A
- 45) B
- 46) D
- 47) A
- 48) B
- 49) B
- 50) D