

Part - 1 (40 pts)

Student ID _____

Name _____

Signature _____

Instructions: This part needs to be solved on this sheet, and is to be returned to the exam staff in the first 40 minutes.

Problem 1. (36 pts) For each of the following multiple choice question, circle the correct choice. There is only correct choice for each question. You must show your working for the questions where mentioned explicitly.

- (1) Consider the circuit shown in Fig. 1 and assume that $V_{out}(0^-) = 0$ and capacitors are ideal. The switch is moved from position A to position B at $t = 2$ sec, back to position A at $t = 4$ sec, and then back to position B at $t = 6$ sec and it remains at B forever. $V_{out}(100)$ is:

- (a) 20 (b) 30 (c) 40 (d) 0

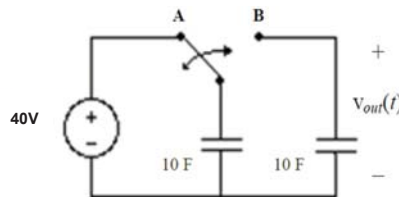


Figure 1:

Correct Answer: 30

- (2) For a circuit shown in Fig. 2, if $R_1 = R_2 = R_3 = R_4 = 10\Omega$ and $R = 20\Omega$, the equivalent resistance of the circuit between the terminals A and B is:

- (a) 25Ω (b) 20Ω (c) 30Ω (d) 35Ω

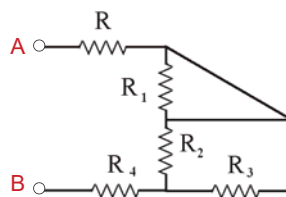


Figure 2:

Correct Answer: 35

- (3) Consider a circuit with two inductors $L_1 = 10H$, $L_2 = 30H$, one resistor $R_1 = 20\Omega$ and a DC voltage source of voltage $V_o = 10V$ connected in series. Determine the

amount of energy (in Joules) stored in two inductors after being connected for a long time.

- (a) 20 (b) 10 (c) 5 (d) 0

Correct Answer: 5

- (4) Consider a circuit with three capacitors $C_1 = 10\mu\text{F}$, $C_2 = 12\mu\text{F}$, $C_3 = 15\mu\text{F}$ and a DC voltage source of voltage $V_o = 7\text{V}$ connected in series. Determine the charge on the capacitor C_1 (in μC). You must show your working in the space provided below.

- (a) 5 (b) 28 (c) 52 (d) 70

Correct Answer: 28

show your working here

- (5) Consider a circuit of network in Fig. 3 with DC voltage source of voltage V_o connected across terminals A and B . If all the resistors have same value, which resistor dissipates the most power?

- (a) R_1 (b) R_2 (c) R_3 (d) R_5

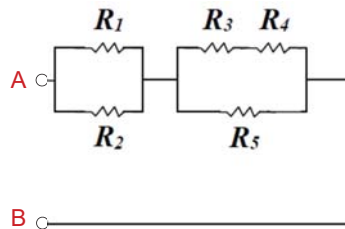


Figure 3:

Correct Answer: D

- (6) For a network with seven nodes and five independent loops, the number of branches in the network is

- (a) 7 (b) 11 (c) 5 (d) 2

Correct Answer: 11

- (7) If an ideal voltage source and an ideal current source are connected in series, what are the properties of the combination?

- (a) The same as voltage source
(b) The same as current source

(c) Different from either a voltage source or current source

Correct Answer: B

(8) The inductance of an inductor connected in the series RLC circuit depends upon:

(a) The amount of current that flows through the inductor.

(b) The time rate of change of current in the inductor.

(c) The geometry of the inductor.

(d) The frequency of the alternating current or voltage source that drives the circuit.

Correct Answer: C

(9) Partial circuit is shown in Fig. 4, where the node voltages are relative to some unknown reference node. The value of the voltage V_x (in volts) is

(a) 6

(b) 24

(c) 8

(d) 10 Correct Answer: 10

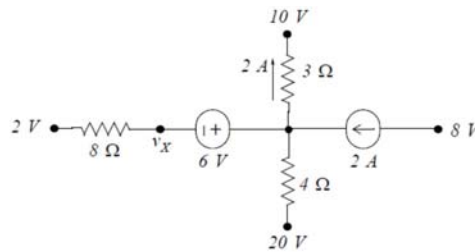


Figure 4:

You must show your working in the space provided below.

show your working here

(10) If an ideal voltage source and an ideal current source are connected in parallel, what are the properties of the combination?

(a) The same as voltage source

(b) The same as current source

(c) Different from either a voltage source or current source

Correct Answer: A

(11) For the circuit given in Fig. 5, the current i (in amperes) is

- (a) -2 (b) 5 (c) 3 (d) 4

Correct Answer: 3

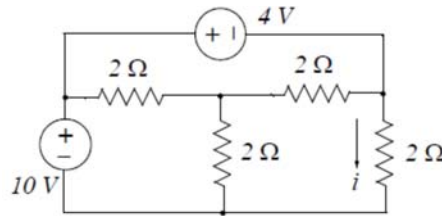


Figure 5:

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- (12) Consider a solenoid with radius r and length ℓ such that $r \ll \ell$. The magnetic field at the center of the solenoid is B_o . A second solenoid is constructed that has twice the radius, twice the length, and carries twice the current as the original solenoid, but has the same number of turns per meter. The magnetic field at the center of the second solenoid is

- (a) B_o (b) $B_o/2$ (c) $2B_o$ (d) $4B_o$

Correct Answer: C

- (13) Consider a circuit containing resistor, inductor, and capacitor connected in parallel across an alternating voltage source of voltage $V_o \sin 10t$. Which of the following statement is correct?

- (a) The instantaneous current through each element must add up to the instantaneous current provided by the driving source.
(b) The instantaneous voltages across each element must add up to the instantaneous voltage of the driving source.
(c) The voltage across capacitor is 90 degrees out of phase with the voltage across resistor.
(d) The voltage across capacitor is 180 degrees out of phase with the voltage across inductor.

Correct Answer: A

- (14) Partial circuit is shown in Fig. 6, where the node voltages are relative to some unknown reference node. The value of the current i (in amperes) is

- (a) -4 (b) $\frac{8}{3}$ (c) -5 (d) -6
 Correct Answer: -6

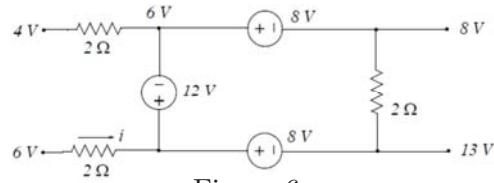


Figure 6:

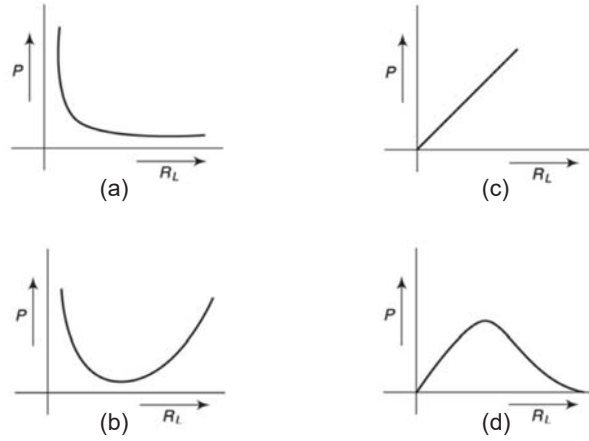
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- (15) If a two terminal element in a circuit has voltage and current variables that follows the associated reference directions and its power is negative, which of the following is true
- (a) The element is supplying energy to the rest of the circuit
 - (b) The element is receiving energy from the rest of the circuit
 - (c) Either (a) or (b) could be true

Correct Answer: A

- (16) The voltage source with internal resistance r_s supplies power to the load of resistance R_L . The power to the load R_L varies with R_L as
 Correct Answer: Mountain



- (17) The value of the current (in amperes) for the circuit in Fig. 7 is
 (a) 1 (b) 1.25 (c) 0.75 (d) 1.5
 Correct Answer: 1.25

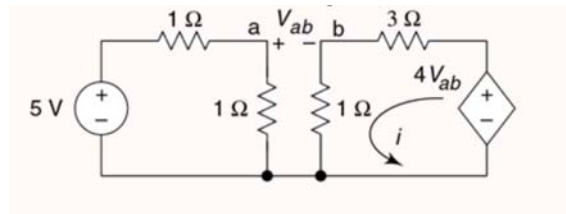


Figure 7:

You must show your working in the space provided below.

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