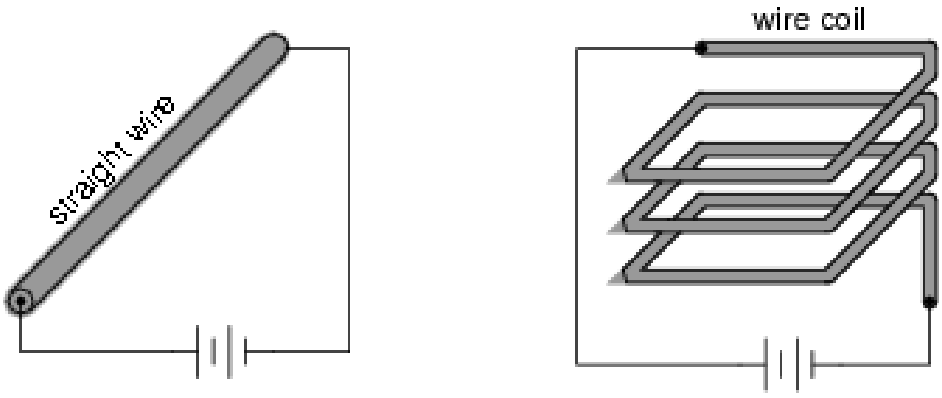
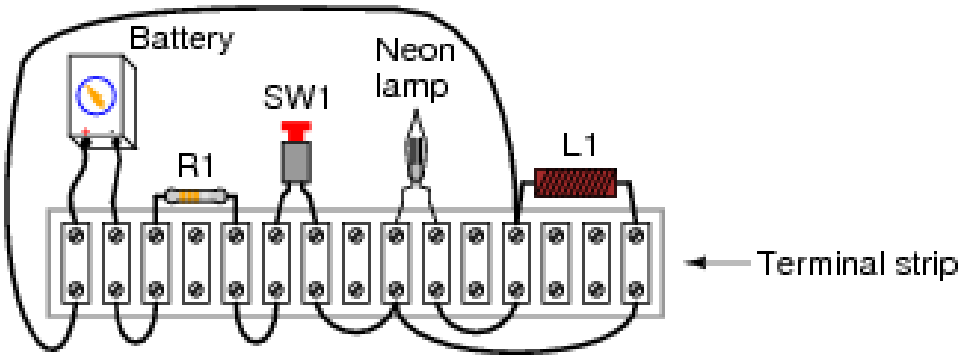
Final Quiz Questions for the Course
"ELECTRONICS and CIRCUITS"

1. Draw the pattern of the magnetic field produced by electric current through a straight wire and through a wire coil:

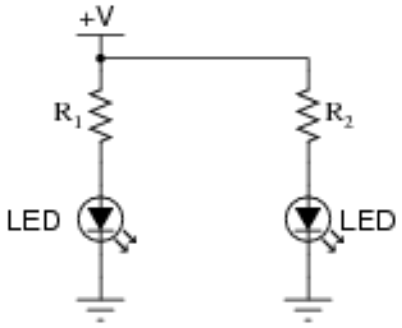


   Explain your answer using either the right-hand rule (conventional flow) or the left-hand rule (electron flow).

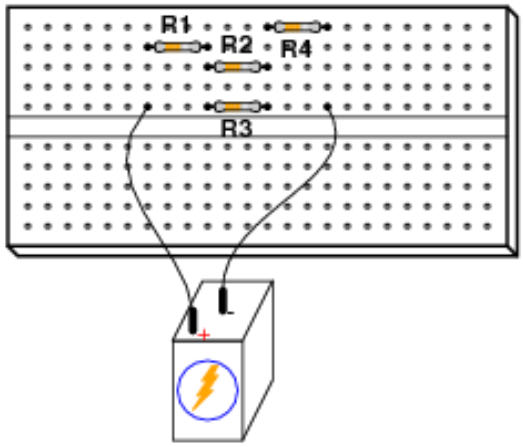
2. Identify and draw block diagram which of these components are connected directly in series with each other, and which are connected directly in parallel with each other:



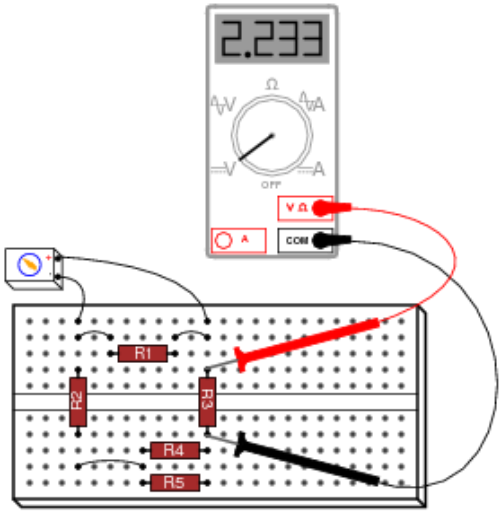
3. Suppose you were designing a circuit that required two LEDs for "power on" indication. The power supply voltage is 15 volts, and each LED is rated at 1.6 volts and 20 mA. Calculate the dropping resistor sizes and power ratings: Re-calculate the dropping resistor ratings (resistance and power) for the new design.



4. Draw a schematic diagram of this “breadboarded” circuit:

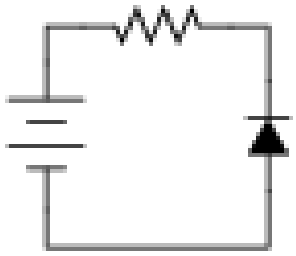


5. Complete the table of values for this circuit:

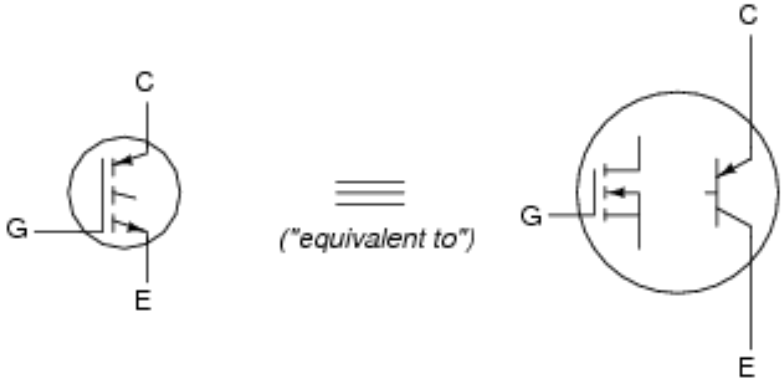


	R_1	R_2	R_3	R_4	R_5	Total
V						
I						
R	2 kΩ	1 kΩ	3.3 kΩ	4.7 kΩ	4.7 kΩ	
P						

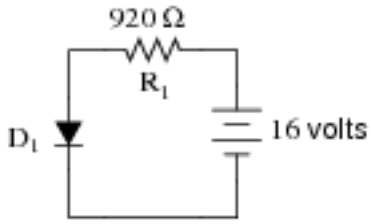
6. Is this diode forward-biased or reverse biased and explain why?



7. Complete the schematic diagram showing an equivalent circuit for an N-channel IGBT, using an N-channel E-type MOSFET and a PNP bipolar transistor:

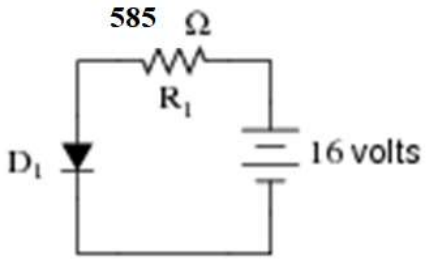


8. Complete the following table of values for this diode circuit, assuming a typical forward voltage drop of 0.72 volts for the diode:



	R_1	D_1	Total
V			16 V
I			
R	920 Ω		
P			

9. Define the following terms: *energy*, *work*, *power* and explain by the equation.
10. Power electronics devices: What kind of transistors can have a collector and emitter and describe all of the details.
11. Power electronics devices: What kind of transistors can have an anode and cathode and describe all of the details.
12. MOSFET: draw the schematic illustration of transistor, energy band diagram and describe the details.
13. Complete the following table of values for this diode circuit, assuming a typical forward voltage drop of 0.28 volts for the diode:



	R_1	D_1	Total
V			16 V
I			
R	585 Ω		
P			

14. What is a Darlington pair and what advantages does it offer?
15. Draw an AND NOT gate using n MOS transistors; write and complete its the state table.
16. Explain, if the current in a circuit is increased by a transformer and the voltage stays constant, how does the power change?
17. Describe the electromechanical energy conversion devices.

18. What is the purpose and main tasks of the science of electronics?
19. Explain the role and importance of *Electronics and Circuits* in modern engineering.
20. Describe major contributions of early and advanced scientists to modern electronics and ICT.
21. Discuss the historical development stages of modern electronics.
22. What are international and national standards used in electronics and electrical engineering?
23. What are electronic circuit simulators and what types exist?
24. Explain the main advantages of using circuit simulation tools.
25. What problems occur when interfacing computer systems with analog systems?
26. Why are standards essential for system coordination and security in electronic interconnections?
27. Explain the concepts of nodes, meshes, and loops in electrical circuits.
28. What are active and passive circuit components? Give examples.
29. Describe replacement (equivalent) circuit schemes and where they are used.
30. What is the difference between branched and unbranched circuits?
31. State Kirchhoff's current law (KCL) and provide an example.
32. State Kirchhoff's voltage law (KVL) and provide an example.
33. Explain the contour current (mesh current) method of solving circuits.
34. Explain the superposition (overlap) method in linear circuits.
35. Describe the nodal potential method.
36. What is the equivalent generator method and when is it used?
37. Explain the behavior of resistive, inductive, and capacitive elements in DC circuits.
38. Describe how Ohm's law is used in DC circuit analysis.
39. What are the main quantities that describe sinusoidal currents (amplitude, phase, RMS, etc.)?

40. How do sinusoidal currents behave in R, L, and C elements?
41. Write Ohm's and Kirchhoff's laws in complex (phasor) form.
42. Explain the behavior of harmonic currents in series and parallel RLC circuits.
43. Define active, reactive, and apparent power in AC circuits.
44. What are frequency characteristics of an electrical circuit?
45. Compare power consumption in resistive and reactive circuits.
46. Explain how phasor diagrams represent AC voltages and currents.
47. Define impedance, admittance, and source types of applied AC circuits.
48. Describe the p–n junction energy band diagram under equilibrium.
49. What changes occur in a p–n junction under nonequilibrium (biasing)?
50. Explain the V–I characteristics of a p–n junction.
51. Name and explain the types of p–n junction breakdown.
52. What are the important electrical parameters of a p–n junction?
53. Explain metal–semiconductor transitions (Schottky junctions).
54. What are heterojunctions and where are they used?
55. Explain the structure and operation of rectifier diodes.
56. How do diode parameters depend on temperature?
57. Describe the mathematical model of an ideal diode.
58. What are Zener diodes and how are they used?
59. Explain the operation of varicap and Schottky diodes.
60. What is a tunnel diode and in what region does it operate?
61. Describe the structure and application of photodiodes and LEDs.
62. What is an optocoupler (optron) and how does it function?
63. Explain the basic structure and operation of n-p-n and p-n-p transistors.
64. What are the main BT connection (biasing) schemes?
65. Describe the energy band diagrams of bipolar transistors.
66. What are the main parameters of BTs and how are they used in design?
67. Explain the equivalent (electrical) model and static characteristics of a BT.
68. What are multilayer semiconductor devices and why are they used?
69. Explain the structure and working principle of a thyristor.
70. What is a field-effect transistor and what advantages does it have over bipolar transistors?
71. Name the main types of FETs and their standard designations.
72. Explain FETs controlled by a p–n junction (JFETs).
73. Describe the structure of MOSFETs with induced channels.
74. Describe the structure of MOSFETs with built-in (depletion-mode) channels.
75. Draw and explain the V–I characteristics of a FET.
76. How do temperature and operating mode affect FET parameters?
77. What determines the frequency and power limitations of MOSFETs?
78. List and explain the main areas of application for FET devices.

79. What are integrated microcircuits (IMS) and how are they classified?
80. Describe planar and epitaxial technologies used in IC fabrication.
81. What are the advantages of using MOS technology in integrated circuits?
82. Explain the structure and features of ICs built on MOS transistors.
83. What is the difference between analog, digital, and mixed-signal ICs?
84. Explain the concept of analog integrated microcircuits (IMS).
85. Describe the structure and function of a stable current generator (BTG).
86. What are the key characteristics of a simple current source circuit?
87. Explain how negative feedback improves amplifier performance.
88. What is a transistor amplifier with feedback and how is it analyzed?
89. What is a Darlington pair and what advantages does it offer?
90. Describe the construction and purpose of a Wilson current mirror.
91. Why are current mirrors widely used in analog IC design?
92. How does transistor matching affect current mirror accuracy?
93. Define a differential amplifier (DK).
94. Describe the symmetrical differential amplifier structure.
95. What are the main parameters of differential amplifiers (e.g., CMRR)?
96. Explain how differential amplifiers reject common-mode signals.
97. What are the advantages of using differential input stages in operational amplifiers?
98. Explain the concept and purpose of an operational amplifier.
99. What basic requirements must an Op-Amp meet?
100. List different types of operational amplifiers.
101. Describe the main parameters of Op-Amps (offset, slew rate, gain-bandwidth).
102. How is an Op-Amp configured as an inverting amplifier?
103. How is an Op-Amp configured as a non-inverting amplifier?
104. What is the purpose of feedback in Op-Amp circuits?
105. Define a logic element (gate) and explain its function in digital circuits.
106. Explain methods for representing binary information.
107. What are the basic parameters of logic elements (noise margin, delay)?
108. Describe the amplitude transmission characteristic of a logic element.
109. What is an electronic switch and how does it differ from an amplifier?
110. Explain the operation of an electronic switch made using a bipolar transistor.
111. Describe the structure and transfer characteristics of FET-based switches.
112. Explain the structure and operation of a simple TTL inverter.
113. Describe the operation of a complex TTL inverter and why it is used.
114. What is the purpose of the Schottky barrier in TTL logic?
115. Explain the inverter circuit made using a MOSFET.
116. Describe the working principles of logic gates made from MOSFETs.
117. What is a complementary MOS inverter (CMOS inverter)?
118. Explain why CMOS circuits consume very little static power.

119. Describe basic logic gates implemented using CMOS technology.
120. What are the main advantages of CMOS over TTL?
121. Explain the switching mechanism of a CMOS inverter.
122. Compare the behavior of bipolar transistors and FETs in digital circuits.
123. What are noise margins and why are they important in digital systems?
124. Describe the difference between analog and digital electronics.
125. Explain the role of semiconductor materials and doping in device operation.
126. What are the main technological challenges in modern microelectronics?
127. Discuss current trends and future prospects in semiconductor technology.

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