

“Integrated Circuits” Activity Pack

Name: _____

Class: _____

Introductory Instructions

Complete the questions and activities in the order shown below. At the end of each section and before and after each activity, see your instructor for further instructions or to have the completed sections/activities checked. This is important, because you will lose marks if you do not do this.

This package should not take longer than 9 periods to complete.

Ask your instructor when the test for this package will be written. Record the date in your organizer. This test date will only be changed under exceptional circumstances.

Read through the entire activity pack before commencing so you have a firm idea of the workload. If you feel you need to spend some time working in the lab during lunches, spares, or after school, see your instructor ASAP. Budget your time wisely!

Resources

1. Petruzella, Frank. Electricity and Electronics 2, Ch. 21 “Integrated Circuits”. Toronto: McGraw Hill Book Company, 1986.
2. Internet Access
3. Analog Trainer
4. LM380, 555, 741, 7805 Integrated Circuits
5. Various Resistors
6. LED

21-1 Integrated Circuit Construction

1. ICs are replacing _____ as rapidly as _____ replaced _____.
2. An IC is...
3. An IC contains...
4. Describe the construction of an IC.

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Activity 1 – Internet Search – Integrated Circuits *(to be done as homework)*

Internet Search – Inductors *(to be done as homework)*

Using an Internet search engine, find and review a distinct educational web site (different from those already found) related to integrated circuits.

Format your review as follows:

Google News -- <http://news.google.ca>

<review goes here>

Email the review to your instructor. Check that your instructor updates the appropriate website review page with this information.

Supplemental Information – Integrated Circuits

For supplemental information on the IC used in this package, visit the following websites:

380 - www.national.com/ds/LM/LM380.pdf

555 - www.national.com/ds/LM/LM555.pdf

741 - www.national.com/ds/LM/LM741.pdf

7805 - www.national.com/ds/LM/LM7512C.pdf

21-2 Advantages and Limitations of ICs

5. Name the advantages and limitations of ICs.

| Advantages | Limitations |
|------------|-------------|
| | |

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21-3 IC Symbols and Packages

Activity 2 – IC Packaging

If your instructor has not already shown the class examples of integrated circuit packaging, ask him or her to do so now.

Record the model numbers and descriptions of at least four of the integrated circuits shown.

| Model # | Description |
|---------|-------------|
| | |
| | |
| | |
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6. Why are ICs mounted in packages?
7. What is a DIP?
8. How do you identify pin #1?
9. Draw a typical 8-pin IC (figure 21-3).

10. Describe SSI, MSI, LSI.

SSI –

MSI –

LSI –

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21-4 Applications of ICs

11. The two major categories of ICs are...

12. What do digital ICs contain?

13. Where are digital ICs used?

14. What does an analog IC contain?

15. What can you say about an analog IC's output?

16. Name some examples where analog ICs are used

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21-5 Operational Amplifiers

17. What is an op-amp?

18. An op-amp can be used to amplify _____ or _____ signals.

19. Draw the schematic symbol for an op-amp; label each of the five basic terminals.

20. The output of an op-amp is obtained between which two terminals?

21. What is the output of an op-amp limited to? (in terms of voltage)

22. What is special about 380 and 741 op-amps?

23. Describe each of the two inputs in terms of polarity.

24. Why are the inputs called *differential input* terminals?

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21-6 Op-Amp Voltage Amplifier

25. What is the typical open-loop gain for an op-amp?

26. How is the gain for an op-amp reduced?

27. Draw the schematic symbol for a basic inverting op-amp circuit.

28. What is the formula for voltage gain for an inverting op-amp circuit?

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Activity 3 – Op Amp Inverting Amplifier

Using an analog trainer, wire up and demonstrate an inverting op-amp circuit. Use figure 21-10 as a guideline. **Do not apply power to the circuit until it has been checked by your instructor.**

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What op-amp IC is used for this activity? _____

21-7 Op-Amp Voltage Comparator

29. Draw the schematic diagram for a voltage comparator circuit.

30. Describe the basic operation of a voltage comparator circuit.

31. How much input voltage difference is needed to cause the output to change?

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37. What IC is used for this purpose in the textbook?
38. What type of previously mentioned op-amp circuit does a timer rely upon?
39. Draw the schematic diagram for a timer circuit.
40. Describe the basic operation of a timer circuit.

Activity 5 – 741 Timer

Using an analog trainer, wire up and demonstrate an op-amp timer circuit. Use figure 21-13 as a guideline. **Do not apply power to the circuit until it has been checked by your instructor.** []

41. What IC has been manufactured specifically for timer circuits?
42. Draw the schematic diagram for a timer circuit using this IC.

Activity 6 – 555 Timer

Using an analog trainer, wire up and demonstrate a 555 timer circuit. Use figure 21-14 as a guideline. **Do not apply power to the circuit until it has been checked by your instructor.**

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Activity 7 – 555 Turing Program

The formula for frequency of a 555 circuit is $f = \frac{1.44}{(R_1 + 2R_2) \times C}$.

Using this formula and material found at <http://www.users.dircon.co.uk/~doctron/555.htm>, write a Delphi program that prompts for component values (R's and C), then outputs frequency and duty cycle.

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Supplemental Assignment (2% Bonus): also write this program in one other language.] []

43. What is the voltage range of a 555 dependent upon?

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21-10 Voltage Regulators

44. Draw the outline of 7805 voltage regulator.

45. What does a voltage regulator do?
46. Draw schematic of a basic 7805 voltage regulator circuit.
47. Describe the basic operation of a 7805 voltage regulator circuit.
48. What is the output current capability of 7805, and under what circumstances?
49. In what applications can a voltage regulator circuit be used?

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Activity 8 – 7805 Voltage Regulator

Using the following guidelines to wire up a 7805 voltage regulator circuit:

- use an analog trainer
- use the variable voltage on the trainer as the “input” to the 7805
- wire an LED circuit to the “output” of the 7805

Do not apply power to the circuit until it has been checked by your instructor.

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Activity 10 – Activity Pack Evaluation

Did you answer all questions in this package?

Did you complete all activities in this package?

Did you find any mistakes in this package? If so, where?

Do you have any recommendations for this package?

Are there any activities you would like to see added to this package?

While you were working on this package, what percentage of the time were you “on-task”?