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**Department of Physics**

**College of Education**

**University of Salahalddin - Hawler**

**Subject: Electronics Laboratory**

**Course Book – (Year 3)**

**Lecturer's name : Dr.Rashad Hasan, Dr. Muhamad Abdullah**

**Academic Year: 2024/2025,First semester**

**Course Book**

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| **1. Course name** | **Electronics Lab.** | |
| **2. Lecturer in charge** | **Muhamad Abdullah Hamad** | |
| **3. Department/ College** | **Physics / Education** | |
| **4. Contact** | [muhamad.hamad@su.edu.krd](mailto:muhamad.hamad@su.edu.krd)  **Tel: ( 0750 4224153)** | |
| **5. Time (in hours) per week** | **Theory: 3 hours/week** | |
| **6. Office hours** | **Tuesday 08:30 – 01:30, 11:30-2:30,2:30-5:30**  **Wednesday 08:30 – 12:30, 11:30-2:30, 2:30-5:30** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** |
| **9. Keywords** | **Electronics, semiconductor electronic experements** | |
| **10. Course overview:**  We try in this course to provide an overview of the principle, operation and application of the analogue building blocks like diodes, BJT, FET etc for performing various functions. This course relies on elementary treatment and qualitative analysis and makes use of simple model and equation to illustrate the concepts involved. Also provide an overview of amplifiers, feedback amplifiers and oscillators.  Students in this course work practically in the laboratory for learning practicing of design and connect electronic circuits constructing from electronic elements. | | |
| **11. Course objective:**  Brief Syllabus: experiments of this course mostly deal with the p-n junction normal and special purpose diode like characteristics of the diode, rectifiers half wave and full wave, clipper ,clamper and voltage doubler. | | |
| **12. Student's obligation**  The students can contribute to a positive learning experience for everyone in the classroom, by fulfilling their fundamental duties:  1. Students should make every effort to maintain good attendance in their classes.  2. Each student should participate in the classroom. Discussing relevant subjects at appropriate times can spark new conversations and produce valuable debates.  3. Students need to respect the ideas and opinions of their classmates in and outside of the classroom.  4. The students should finish homework before entering the classroom.  **Grade information:** Weekly assignments (total weight 10% of grade). Midterm1 (15% of grade), Midterm2 (15% of grade) and Final exam (60% of grade) | | |
| **13. Forms of teaching**  **13.** **Forms** **of** **teaching**  **I** **will** **try** **to** **use** **a** **variety** **of** **teaching** **methods,** **including** **lectures,** **tutorials,** **project** **work,** **discussion,** **and** **computer-aided** **learning..** **I** **will** **focus** **on** **the** **way** **the** **discussion** **with** **the** **students,** **where** **students** **participate** **through** **questions** **solution** | | |
| **14. Assessment scheme**  **Exams**: midterm 21 ( November), and final exam.  Exams are meant to test your understanding and ability to apply concepts covered in the course. I therefore do not expect you to memorize constants and equations. I will provide you with a sheet of relevant equations. I will give you the value of any constants you need. Although the main focus of the exams will be problem solving, all exams will likely contain one conceptual question with a written part to verify that you understand and can explain the physical concepts. Exam and homework problems will be from the textbook | | |
| **15. Student learning outcome:**  **Student Outcome Learning: 15.** **Student** **learning** **outcome**    Experiment ONE: Studying characteristic of the Diode  Learn the relation between the Voltage applied on the diode and the current pass through the Diode.  **General**  Silicon diodes are semiconductor diodes. Since the maximum permissible temperature is 150­oC, these diodes used for considerably higher powers than germanium diodes. Moreover, silicon diodes have a considerably higher reverse resistance. At a certain inverse voltage, the reversed biased silicon diode suddenly breaks down. The breakdown normally leads to the destruction of the diode. Silicon diode 1N4007, for example, have breakdown voltage 1000 V and permissible maximum current one A for the forward bias.    **Discussion:**   1. The current has very small values in the forward bias and then it increases toward very large values suddenly. Why? 2. The voltage reaches to nearly constant values in the forward bias. Why? Is this value varying by varying the type of the diode?   Does the current pass through in the reverse bias? Why? And is this phenomena whether benefit or not? How  Experement two: Stdying the characteristic of the Zener Diode  Learn the relation between the Voltage applied on the diode and the current pass through the ZenerDiode  **General**  Zener diodes are special silicon diodes. In the forward direction, there is no difference between its characteristic and that of a normal silicon diode. When it operated in the reverse direction, a very small reverses current flows, which does not increase at first, even when the inverse voltage increased. However, if the inverse voltage exceeds a certain value, the Zener diode suddenly becomes conductive. Up to certain values, this effect is due to the Zener effect. What is more, the so-called avalanche effect, which also makes the diode capable of conducting in the reverse direction, then also manifests itself. This effect will not destroy the diode until a permissible rise in temperature has taken place and it is therefore use for stabilization.  The ratio of the change of voltage in reverse direction to the change of current due to this effect called the Dynamic resistance rz. The breakdown point is determined by the doping, and the voltage at which that occurs called the Zener voltage Vz.    **Discussion:**   1. What is your conclusion about the curve? 2. What is your conclusion concerning dynamic resistance for ZF4.7 and ZX10? 3. It known that Zener diode used for voltage regulation. Why?   What is the major factor in which determine the quality of regulation from your results  **EXP. 3**  **Half-wave Rectification and Filtering**  **Aim of the Exp.:**   1. To be able to construct a circuit with a transformer, diode, load resistor and reservoir capacitor for half-wave rectification of an A.C. voltage. 2. To be able to measure the output voltage as a function of time with the Oscilloscope and as direct voltage with the moving coil meter Vdc. 3. To be able to recognize the dependence of the output voltage in respect of its curve shape and magnitude upon the size of the reservoir capacitor and load resistor.     **Discussion:**   1. What is the role of the capacitor C? 2. What is the effect of increasing each of C and RL on Vdc? And what is the shape of your relation in your results? 3. How Vdc could calculate, approximately, from the graph instead of voltmeter measurements? 4. The frequency used in this experiment was equal to the mains frequency (50 Hz), if the frequency was 50 kHz, for example, what you suggest:   a- varying values of C and RL.  b- Changing electronic element.  **Exp. 4**  **Centre-point connection for full-wave Rectification**  **Aim of the Exp.**  To be able to construct a circuit arrangement with a mains transformer with a centre-tapped winding, two diodes and a reservoir capacitor to produce a full-wave rectifier circuit.  **Apparatus and Components**   1. Two diodes: 1N4007 2. Resistors: 100 Ω, 1 KΩ 3. Capacitors: 1 μF, 100 μF 4. A.C. Power supply: 12 V, 6 V, 0 V   One oscilloscope, One Multimeter (high resistance    **Discussion:**   1. Discuss shortly the role of each: D1, D2, RL, C. 2. Compare the differences in the results of this experiment with the previous one, (Rectification and Filtering half-wave), in terms of VDC, V-p and the output wave frequency?   Suppose you have a transformer which doesn't own central tapping, (only two polar), and you are asked to rectify a full wave using two diodes, what must you add to the circuit to operate normally  **Exp. 5**  **Bridge circuit for Full-wave Rectification and Filtering**  **Aim of the Exp.:**  To be able to connect a bridge circuit for full-wave rectification with a source of alternating voltage, four diodes and a load resistor or a filter chain    **Discussion:**   1. Discuss the role of D1 and D2 in both the first half and second half of the wave (cycle)? 2. Compare most important differences between this experiment and the previous one, in terms of VAC, VDC. 3. What are the reason for the following:    1. The bridge method is preferred on the rectifier method for a centre-tap transformer.   The bridge method not recommended for a low-amplitude wave rectification  **Exp. 6**  **Voltage Doubler**  **Aim of the Exp.:**  To be able to built up a circuit with a source of alternating voltage, two diodes and two capacitors in such a way that a doubling of the voltage occurs    **Discussion:**   1. Summarize operating both D1 and D2 in Fig.1, and what is the basic characteristic in connecting C1 and C2 (in parallel or series)? 2. What is the effect of RL, and what is the relation of each VDC1, and VDC2 with VDC3 usually?   What is the output voltage for the following circuit if Vrms=10 V? How obtain this output values (analysis the circuit)  **Exp. 7**  **Clipping Circuits**  **Aim of the Exp.:**  To be able to build up a circuit with AC and DC power supplies, diode and resistor in such a way that clipping the wave (clipping the positive and negative part, and both parts together).    **Discussion:**   1. In both cases (A) and (B), Explain how is the output shape of E=0?   What is the use of clipping circuits  **Exp. 8**  **Clamping Circuits**  **Aim of the Exp.:**  To be able to build up a circuit with AC and DC power supplies, diode and resistor in such a way that clamping the wave.    **Discussion:**   1. Discuss the circuit operation in Fig. 1 and compare it with Fig. 2? 2. Compare the case in Fig. 1 with that of Fig. 3?   What are the uses of clamping circuit | | |
| **16. Course Reading List and References‌:**  **Textbooks**: Fundamental of College Physics , peter J. Nolan.  Reference Books: Modern Physics, Serway, Moses and Moyer, 3rd edition, Thomson, Brooks and Cole 2005. | | |
| **18. Practical Topics (If there is any)** | |  |
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| **19. Examinations:** | | |
| **20. Extra notes:** | | |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ** | | |