Department of Physics

College of Science

University of Salahaddin

Applied Electronics

Course Book – (3rd Year Physics)

Lecturer's name ***Dr. Khalid A. Abbas***

Academic Year: 2021-2022

Course Book

Course Book

1. Course name	Applied Electronics
2. Lecturer in charge	Dr. Khalid A. Abbas
3. Department/ College	College of Science, Physics Department
4. Contact	E-mail khalid.abbas@su.edu.krd
5. Time (in hours) per week	Theory: 3.0 (Three only) Practical: 12
6. Office hours	At least 5 h/week
7. Course code	
8. Teacher's academic profile	I studied for an undergraduate degree in Physics science at Salahaddin University-Erbil between the years of 1982- 1986. I obtained MSc in Nuclear Physics in 1991. In 1992, I got a position in Salahaddin University as a laboratory supervisor (Thermodynamics, general physics lab.). In 2008 I obtained Ph.D. and now I lecture the subject "Applied Electronic" for the third grad physics students.
9. Keywords	Applied electronics, electronic circuits.

10. Course overview:

This course presents an overview of the fundamentals of electronic circuit application, starting with an overview of electronic components then application.

11. Course objective:

The objective of applied electronic is to introduce basic principles of applied electronics. Starting from basic components to circuits.

12. Student's obligation

Normally, students obliged to attend all the lectures and take notes during the lecture. In addition, in class participation would be a bonus of the students to widen their knowledge

and understand the module thoroughly. Attending the lectures regularly would be a crucial point for the students to consider, because the module is very new and very detailed. If the students missed few lectures, they would have difficulty to get back on the track.

Additionally, students are ought to submit and their home works and assignments given by their lecturer, because there would be penalties for the late submission. All exams and tests done with books closed, and, students have to take at least two compulsory exams with few class test and quizzes during the years of study.

13. Forms of teaching

I am using some ways to make the students engage with the lecture like power point slides explanation view, white bard in the class and animations to explain the theory of the subject and then the students also must give attention to the explanation in the class. If there were slides that needed more explanation the rest, or, if the slide needed a long, explanation and I thought that the students must know all of that, I would distribute the printed out version of the description on the students to widen their knowledge on the subject.

14.Assessment scheme

Three monthly examination	30 %
For each chapter one Quiz	10%
Final examination	60%

15. **Student learning outcome:**

Students who took the lectures of electronic would easily be able to use and maintenance of electronic devices and learn the principles used in all areas of electronics.

16.Course Reading List and References:

The main text books are:

1. **Practical Electronic for inventors, By: Paul Scherz 2000.**
2. **Electronic Device and circuit theory, By R. Boylestand and L. Nashelsky, 7th ed.**

17. The Topics:	**Lecturer's name**
Week1, 2, and 3: CH1: General Introduction to Semiconductor Physics 1.1- Energy band in Solid: 1.2- Conductors, Insulators and Semiconductors: 1.3- Atomic Binding in Semiconductors 1.4- Types of Semiconductors 1.5- PN-junction 1.6- IV- Characteristic for PN-junction diode **Week4, 5, 6 and 7: CH2: Bipolar Junction Transistor** 2.1 Introduction 2.2 Important Biasing rules 2.3 Transistor Currents components 2.4 CB Configuration 2.5 Transistor Static Characteristics 2.6 Common Base Static Characteristics 2.7 CE Configuration 2.8 Common Emitter Test Circuit 2.9 CC Configuration 2.10 BJT Formula. 2.11 Solve problem. **Week8, 9, 10, 11 and 12: CH3: Load lines and DC Bias circuit** 3.1- Important of V_{CE}: 3.2- D.C. Load Line 3.3- BJT Switches (at cutoff and saturation region) 3.4- Notation for Voltages and Currents 3.5- Transistor AC/DC Analysis 3.6- D.C load Line (Active Region) 3.7- Quiescent Point 3.8- Load Line and Output characteristic 3.9- AC Load Line 3.10- Temperature affecting bias variations 3.11- Stability Factor 3.12- Different Methods for Transistor Biasing 3.13- Solve problem **Week13, and 14: CH4: Darlington Transistors** 4.1 Darlington Transistors 4.2 Some application	**Dr. Khalid** **Length: 3 hours per week**

4.3 Solve problem

Week 15: first Exam

Week16, 17 and 18: **CH5: TRANSISTOR EQUIVALENT CIRCUIT AND MODELS**

5.1- Introduction:
5.2- Amplification in the AC dommin
5.3 The BJT as an Amplifier and the important parameter (Zi, Zo, Av, Ai).
5.4 The transistor re model:
5.5 The hyper equivalent circuit

Week19, 20, 21 and 22: **CH6: TRANSISTOR EQUIVALENT CIRCUIT AND MODELS**

6.1 The Field Effect Transistor (JFET) physical principles
6.2 Static Characteristics of JFET
6.3 Common source
6.4 Common Drain
6.5 FET as a switch and an amplifier
6.6 Solve problem

Week23, 24, and 25: **CH7: Operational Amplifier**

7.1 Operational Amplifier Op Amp
7.2 Equation of Op Amp
7.3 The inverting
7.4 Non-inverting,
7.5 Summing,
7.6 Integrating,
7.7 Schmidt trigger amplifier

Week 26, 27, 28 and 29,: **CH8: Digital Electronic**

8.1 The binary number system
8.2 Digital electronic and some medical application

Exam: week 30

19. Examinations:

A sample:

Q.1: Chose the correct answer: (10Mark)

1. Conduction electrons have more mobility than holes because they
(*a*) Are lighter.
(*b*) Experience collisions less frequently

(*c*) Have negative charge.
(*d*) Need less energy to move them.

2. When a *P-N* junction is formed, diffusion current causes
(*a*) Barrier potential.
(*b*) Mixing of current carriers
(*c*) Forward bias
(*d*) Reverse bias.

3. For current working of an *NPN*- BJT, the different electrodes should have the following polarities with respect to emitter.
(*a*) Collector +ve, base –ve
(*b*) Collector –ve, base + ve
(*c*) Collector – ve, base –ve
(*d*) Collector + ve, base +ve

4. The value of total collector current in a *CB-configration* circuit is
(*a*) $I_C = \alpha I_E$
(*b*) $I_C = \alpha I_E + I_{CBO}$
(*c*) $I_C = \alpha I_E - I_{CBO}$
(*d*) $I_C = \alpha I_E + I_{CEO}$

5. Early-effect in BJT refers to
(*a*) Ajunction break down
(*b*) Thermal break down
(*c*) Base narrowing
(*d*) Zener break-down

Q2:Give the reason behind: (20 Mark)

1- *Two diodes cannot take please or work as a BJT.*
2- *We don't need to change the polarity of bias battery for CE –BJT circuit to change the mode of the transistor from active to saturation.*
3- *The different phase between input and out AC voltage for CE –amplifier*
4- *The best location of the Q point it's in the middle of the load line.*

Q3: *For a certain transistor, I_C=5.505 mA, I_B = 50 µA, I_{CBO} = 5 µA. Determine:*
(i) *Values of α, β and I_E*
(ii) *The new level of I_B required to make I_C=10 mA.* *(20 Mark)*

Q4: In a simple amplifier circuit (Fig. 1) with base resistance, R_B = 50 K, R_E = 2 K, R_C = 3K, V_{CC} = 10 V, β = 100, determine whether or not the silicon transistor is in the saturation.

(20 Mark)

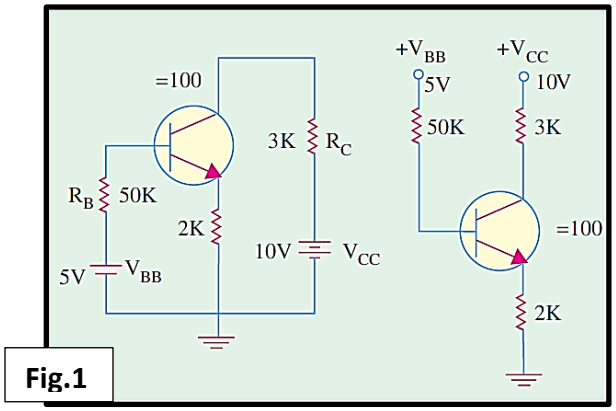

Fig.1

Q5-A: Given the load line of (Fig. 2) and the defined *Q*-point for insert circuit, determine the required values of V_{CC}, R_L, and R_B for a fixed-bias configuration.

(15 Mark)

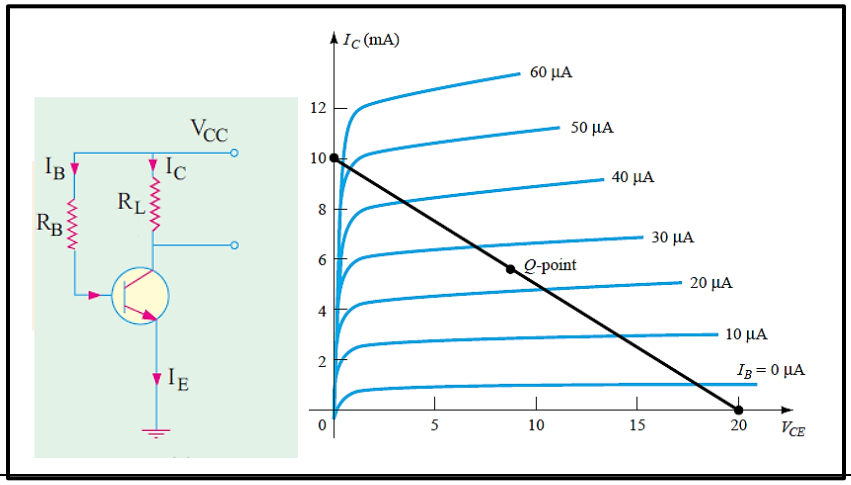

Fig.2

Q5-B: *Determine the value of R_B required adjusting the circuit of (Fig. 3) optimum operating point (Q-point). Take β = 50 and V_{BE} = 0.7 V.*

(15Mark)

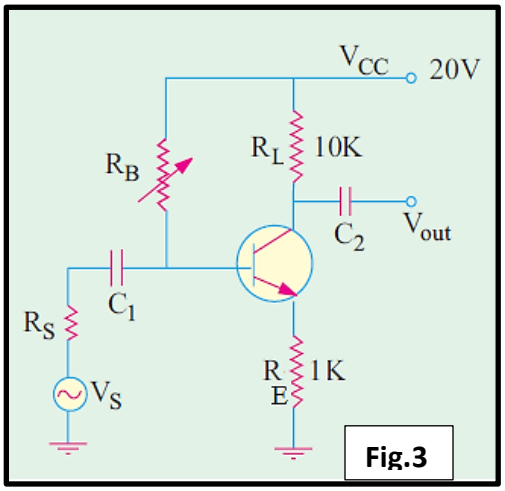

Fig.3

Good Luck

Lecturer
Dr. Khalid A. Abbas

20. Extra notes:

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21. Peer review