(Advanced Electronics) Course Catalogue 2023-2024

College	**Erbil Technology College**	
Department	**Automation Industrial Technology Engineering (AITE)**	
Module Name	**Advanced Electronics**	
Module Code	**ADE705**	
Semester	**7**	
Credit	**6**	
Module type	**Core**	
Weekly hours	**4**	
Weekly hours (Theory)	**(2)hr Class**	**(118)hr Workload**
Weekly hours (Practical)	**(2)hr Class**	**(64)hr Workload**
Lecturer (Theory)	**Dr. Shelan M Mustafa**	
E-Mail	**Shelan.mustafa@epu.edu.iq**	
Lecturer (Practical)	**Dr. Shelan M Mustafa**	
Email	**Shelan.mustafa@epu.edu.iq**	

Course Book

- Course overview:

This course provides a comprehensive introduction to the active components used in electronic circuitry, delving into their operational principles. The curriculum covers various transistor biasing techniques and the details of operational amplifiers, with a particular focus on their types and applications vital to industrial automation technology engineering. Key topics include amplifiers, operational amplifiers, and oscillators. Through a mix of theoretical lectures and practical labs, students will gain expertise in the design, operation, and integration of these amplifiers within automation systems. The course emphasizes the role of these components in boosting precision, efficiency, and the ability to critically assess analog circuits, ensuring reliability in contemporary industrial processes and machinery.

- Course objective:

To study the amplifiers and Oscillators circuits
To understand the operational amplifiers

- **Student's obligation ►**

The importance of assignments is emphasized as they will help the learner to master the various topic and subtopics involved fully. As a result, it will be necessary for every student to attempt all examinations and problems presented in the course carefully. The responses to the assignments will be provided after the submission and that no examination will be accepted after the due date. All assignments are supposed to be submitted every Monday and subsequently marked in the course of the week.
► Students are expected to be punctual in the class attendance as lateness creates disturbance to everyone. Students with an absence rate that exceeds 10% by the end of the course will not be allowed to sit for the final examination. ► Students are required to switch off their cell phones during class as they can be a source of distraction.

- **Forms of teaching**

Learning will take place in lecture halls with data show equipment and whiteboard for class presentations. Besides, lectures, office hours, and textbooks will be essential resources for the course. Students will have two ways by which they can obtain the course resources. I will post all the lectures, LAB sheets, and assignments on my faculty website. Alternatively, you can obtain a hard copy in the subsequent classes. Theoretical lectures will be presented through data show and exampled explained on the whiteboard within the three-hour weekly lesson. Lab sessions will run for two hours once a week

- **Assessment scheme**

60% Semester

- **5%**

Homework (Two home works are the minimum required)

- **2%**
- Class Activity
- **10%**

Report, Seminar, Paper, Essay and Project (Two of them are the minimum required)

- **10%**

Lab Report and it's activity

- **8%**

Quiz ((Two Quizzes are the minimum required)

- **25%**

10% Theory /Mid Term Exam
15% Practical /Mid Term Exam

40% Final Exam

- **20%**Theory
- **20%**Practical

- Specific learning outcome:

At the end of the course, the student is to be able to:

1. Describe the transistors and their principles of operation.
2. Know the basics of small signal and multistage amplifiers.
3. fundamental understanding the primary purposes of operational amplifiers.
4. Learn about of oscillators and the use of feedback in electronic circuits.
5. Show skill in solving electronic circuit problems.
6. demonstrate the ability to use the techniques, skills, and modern engineering tools necessary for circuit design
7. demonstrate the ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
8. Exhibit good communication skills and function effectively on teams
9. Applying Electronics Engineering course work to open-ended projects Introduction to Electronic Prototyping

- **Course Reading List and References:**
- Albert Malvino .Electronic Principles 8th edition,2016. McGraw-Hill Education.
- Robert L. Boylestad & Louis Nashelsky, 2011. Electronic Devices and Circuit Theory (11th Edition) ,
- Ramakant A. Gayakwad, "Operational Amplifiers with Linear Integrated Circuits", 4th Edition, Prentice Hall, New Delhi, 2004
- J.G. Graeme, "Application of Operational Amplifiers: Third Generation Techniques", The Burr-Brown Electronics Series, McGraw-Hill, New York, 1973.
- Vladimir V. Mitin,"Introduction to Nanoelectronics, Science, Nanotechnology, Engineering and Applications "Cambridge University Press, 2008

- **Course topics (Theory)**	**Week**	**Learning Outcome**
Introduction to Bipolar junction transistor, the unbiased transistor, the biased transistor, transistor current, transistor curve, transistor approximation, reading data sheets, the load line, the operating point, Recognizing Saturation, Surface mount transistors, Troubleshooting	1	1
BJT Biasing : DC analysis, The operating point, BJT Biasing Fixed Bias Configuration, Emitter -Bias Configuration, Voltage -Divider Bias Configuration, Emitter -Follower Bias Configuration(common- collector), Common Base (CB) Configuration	2	2&5&6
BJT biasing: Ac analysis,The coupling Capacitor, The bypass capacitor, BJT Biasing , Small-Signal Operation, Voltage gain, Base-Biased amplifiers, Voltage -Divider amplifiers, Emitter -Bias amplifiers, r_e model, Analyzing an amplifier, Ac quantities on the data sheet	3	2&5&6
BJT biasing: Ac analysis cont., common-emitter fixed bias, Voltage- divider bias, common-emitter fixed bias: unbypassed	4	2&5&6
BJT biasing: Ac analysis cont., common-emitter bias: with bypassed capacitor, Emitter-follower amplifier, Common-base configuration, Collector feedback configuration, Effect of RL and RS, Effect of RL and RS on voltage divider configuration, Effect of RL and RS on Emitter-follower amplifier, Current gain	5	2&5&6
Multistage Amplifier: Definirion, Two-stage feedback, Cascaded system, Cascode connection, Darlington connection	6	2&7&8&9

Power Amplifier: class A power amplifiers, Class B and class AB push-pull amplifiers, class C amplifier	7	2&7&8&9
Basic OP-AMP circuits: Comparators, summing amplifiers, integrators and differentiators, troubleshooting	8	3&7&8&9
Frequency Effects: Frequency response of an amplifier, Decibel power gain, Decibel voltage gain, Impedance matching, Decibels above a reference, Bode plots, More bode plots, The Miller effect, Rise-time bandwidth relationship, Frequency analysis of BJT stages, Frequency analysis of FET stages	9&10	4&7&8&9
Introduction to nanoelectronics: materials for nanoelectronics, resonant-tunneling diodes, single-electron-transfer device, potential-effect transistor, quantum-dot cellular automata	11&12	7&8&9
- **Course topics (practal)**	**Week**	**Learning Outcome**
study about electrical symbols and laboratory equipments.	1	6
Use of Transistors for Switching	2	1&6
Transistors as an Amplifier: Setting the Operating Point	3	1&6
Biasing Amplifier circuits	4	1&6&8
Two-stage amp with capacitive coupling:Part1	5	2&6&7&8
Two-stage amp with capacitive coupling:Part2	6	2&6&7&8
Two-stage amp with direct coupling	7	2&6&7&8
Two-stage amp with direct coupling: Bootstrap circuit	8	2&6&7&8
Constant current source using a bipolar transistor	9	2&6&7&8
Operational amplifiers: inverting amplifier circuit	10	3&7&8&9
Operational amplifiers: non- inverting amplifier circuit	11	3&7&8&9
Operational amplifiers: Comparator operating response	12	3&7&8&9
- Examinations (question design):		

Ministry of Higher Education and Scientific research

Ministry of Higher Education & Scientific Research
Erbil Polytechnic University.
Erbil Technology College
Automation Industrial Technology Engineering(AITE)

Academic year: 2023 – 2024
1st Examination — Fall Semester

Class: Fourth (7th Semester)
Module: Advanced electronics
Code:**ADE705**
Time: **120 Min**
Date: 3 \ 01 \ 2024

Q1/ For **Fig.1**, the collector feedback configuration, determine r_e, Z_o and A_v — 25 Mark

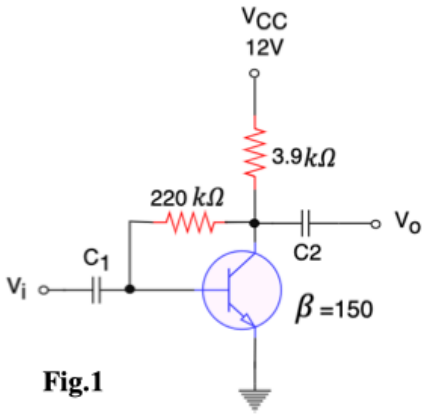

Fig.1

25 Mark

Q2/

Determine the voltage gain A_v , power gain A_P and efficiency η of the class A power amplifier in **Fig.2** , $\beta = 200$ for all transistor

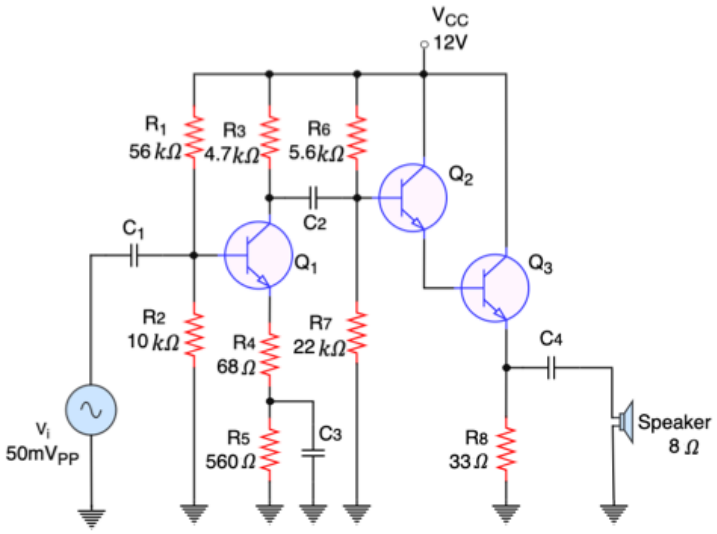

Fig.2

Continue

25 Mark

Q3/

For the cascode amplifier circuit of **Fig.3**, calculate the dc bias voltages V_{B_1}, V_{B_2}, V_{C_2}, A_{vNL} ,V_o. and A_{vL} across a 10 KΩ load connected at the output of the circuit.

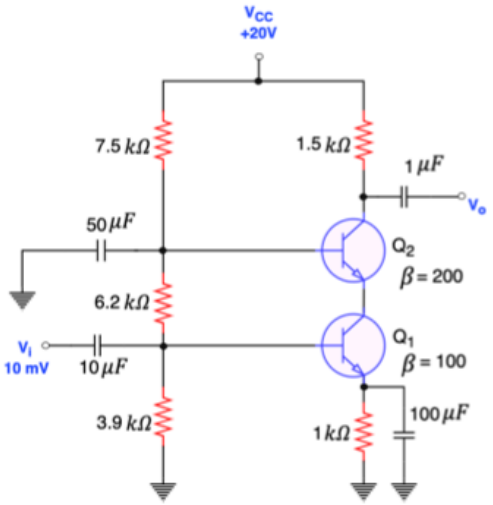

Fig.3

25 Mark

Q4/

From **Fig. 4,**

a) Consider the ideal op-amp circuit shown in Figure Determine the voltage gains $A_{v1} = V_{o1} / V_{in}$ and $A_{v2} = V_{o2} / V_{in}$.

(b) For $R2$ = 60kΩ, $R1$ = 20kΩ, and R =50kΩ, determine V_{o1} and V_{o2} for V_{in} = -0.5V

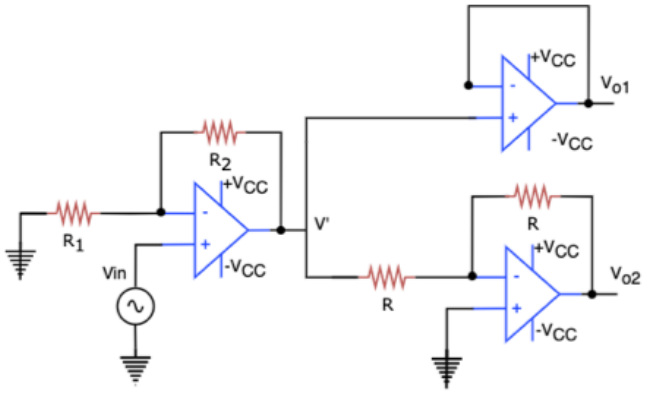

Fig.4

Good Luck and best wishes

Dr. Shelan M. Mustafa
Lecturer

- **Extra notes:**

- **External Evaluator**

The course-book is well organized, and it is a suitable learning for fourth-stage students in the field of automation industrial technology engineering.

Muhammed A. Ibrahim
Professor
Salahaddin University
Electronics and Communication Dep.
mabdulbaki@su.edu.krd