

Department of Physics, IIT Kanpur

PHY441A/ PHY647A (Electronics)

2-1-3-0-11

31/07/2017

Objectives:

- To make students understand concepts in basic electronics (Analog and Digital) from a physicist's point of view along with hands on experience in circuit building and troubleshooting.

- The knowledge and experience gained during the course should help the student in handling and understanding electronic instruments in research laboratories.

Prerequisites:

There are no prerequisites for the course, however it is expected that the student is familiar with working of semiconductor diodes and transistors. A basic understanding of computer programming at the beginner level is also desirable.

Course Contents:

Lecture Topics (each topic will be dealt in 3~4 lectures):

- Analog electronics
 1. Basics and network analysis
Thevenin theorem, Norton theorem, Power dissipation
 2. Operational amplifiers - I
Operational amplifiers (IC-741), Negative feedback amplifiers, Math operations
 3. Operational amplifiers - II
Opamp limitations (bias current, offset voltage, slew rate etc.), RC oscillator
 4. Opamp + Diodes
Circuits with diodes and OpAmps, Regulators and power supplies
 5. Opamp + Transistors

Current source, CE amplifier, Push-pull amplifier, Schmitt trigger

6. MOSFETs, CMOS (Optional)

- Digital Electronics

7. Digital electronics - I

Number system, Boolean algebra, Logic gates, Adder

8. Digital electronics - II

Flip-flops, registers, counters, AD/DA Conversion

9. Architecture of 8051 microcontroller

10. Assembly language programming

11. Applications of 8051 microcontroller

Course organization - Schedule

Instructor	:	Aditya H. Kelkar (email: akelkar@iitk.ac.in)
Day & time	:	Lectures : Mon & Thu @ 11:00 hrs
		Tutorial : Tue @ 11:00 hrs
		Lab : Mon & Tue 14:00hrs – 16:00hrs
Venue	:	L-12 (lecture and tutorial)
	:	Electronics lab (New core building) (Lab sessions)

Course organization – Evaluation

Total marks = 400

a) Surprise quizzes (4)	:	10 marks each (15-20 mins)
b) Mid Sem exam (theory)	:	80 Marks (2 hrs)
c) End Sem exam (theory)	:	120 Marks (3 hrs)
d) Lab exam (Mid + End)	:	40 + 40 Marks (2+2 hrs)
e) Lab performance	:	80 Marks

Course Policies:

- Minimum **90% attendance** is compulsory to appear in the end-semester examination.
- Attendance in the **End semester examination is necessary** to secure a passing grade. Failing to do so will automatically lead to an F grade irrespective of your performance in previous exam components.
- No make-up will be offered for quizzes, mid-sem and lab exam.

Books & References:

1. *The art of electronics* by P. Horowitz and W. Hill (Cambridge university press, 2nd Ed., 2008)
2. *Electronics principles* by A. P. Malvino and D. J. Bates
3. *Electronic devices* by T. L. Floyd (Pearson education, 2005)
4. *Student manual for the art of electronics* by T. C. Hayes and P. Horowitz (Cambridge university press)
5. *Op-Amps and linear integrated circuits* by R.A. Gayakwad (Pearson education, 4th Ed., 2000)
6. *Digital fundamentals* by T. L. Floyd (Pearson education, 2006)
7. *Digital principles and applications* by D. P. Leach, A. P. Malvino and G. Saha (Tata McGraw- Hill, 7th Ed., 2011)
8. *The 8051 Microcontroller: architecture, programming and applications"* by K. J. Ayala (West publishing Co., 1991)