



BASIC ELECTRONICS

PROF. M.B. PATIL

Department of Electrical and Electronics Engineering
IITB

TYPE OF COURSE : Rerun | Core | UG**COURSE DURATION :** 12 Weeks (18 Jan' 21 - 09 Apr' 21)**EXAM DATE :** 25 Apr 2021**PRE-REQUISITES :** A basic course in electrical engineering (KCL, KVL, network theorems, AC analysis)**INTENDED AUDIENCE :** Students, PhD scholars, teachers, industry**INDUSTRIES APPLICABLE TO :****COURSE OUTLINE :**

The course is about basic electronic circuits, both analog and digital. In the analog part, diode circuits, BJT amplifiers, Op Amp circuits will be covered. In the digital part, combinatorial and sequential circuits will be covered. A unique feature of the course is extensive use of circuit simulation results in order to give a realistic picture of the circuit operation and waveforms. Assignments are designed to help the students to test their understanding of the concepts being covered. A circuit simulation package will be made available (as free download) to enable students to simulate circuits covered in the course and gain further insight in their functioning.

ABOUT INSTRUCTOR :

Prof Mahesh B. Patil received his B. Tech. from IIT Bombay in 1984, MS from University of Southern California in 1987, and PhD from University of Illinois at Urbana-Champaign in 1992, all in Electrical Engineering. He has worked as a faculty member at IIT Kanpur from 1994 to 1999, and at IIT Bombay from 1999 to date. His research interests are semiconductor devices and circuits simulation. He has been teaching electronics lab and theory courses for several years, and has written a book Basic electronic devices and circuits (PHI, 2013). He has also prepared course material in the form of presentations on various topics covered in electronics courses (www.ee.iitb.ac.in/~sequel). For his teaching efforts, he received an Excellence in Teaching award from IIT Bombay in 2012.

COURSE PLAN :

Week 1: Lecture 1 : A brief history of electronics • Lecture 2 : Superposition • Lecture 3 : Useful circuit techniques-1
Lecture 4 : Useful circuit techniques-2 • Lecture 5 : Phasors-1 • Lecture 6 : Phasors-2

Week 2: Lecture 7 : RC/RL circuits in time domain-1 • Lecture 8 : RC/RL circuits in time domain-2
Lecture 9 : RC/RL circuits in time domain-3 • Lecture 10 : RC/RL circuits in time domain-4 • Lecture 11 : RC/RL circuits in time domain-5 • Lecture 12 : Simulation of RC circuit

Week 3: Lecture 13 : Diode circuits-1 • Lecture 14 : Diode circuits-2 • Lecture 15 : Diode circuits-3
Lecture 16 : Diode circuits-4 • Lecture 17 : Diode circuits-5 • Lecture 18 : Diode circuits-6

Week 4: Lecture 19 : Diode rectifiers-1 • Lecture 20 : Diode rectifiers-2 • Lecture 21 : Diode rectifiers-3
Lecture 22 : Bipolar Junction Transistor-1 • Lecture 23 : Bipolar Junction Transistor-2 • Lecture 24 : Bipolar Junction Transistor-3

Week 5: Lecture 25 : BJT amplifier-1 • Lecture 26 : BJT amplifier-2 • Lecture 27 : BJT amplifier-3
Lecture 28 : BJT amplifier-4 • Lecture 29 : BJT amplifier-5 • Lecture 30 : BJT amplifier-6

Week 6: Lecture 31 : BJT amplifier-7 • Lecture 32 : Introduction to op-amps • Lecture 33 : Op-amp circuits-1
Lecture 34 : Op-amp circuits-2 • Lecture 35 : Op-amp circuits-3 • Lecture 36 : Difference amplifier

Week 7: Lecture 37 : Instrumentation amplifier-1 • Lecture 38 : Instrumentation amplifier-2 • Lecture 39 : Op-amp nonidealities-1
Lecture 40 : Op-amp nonidealities-2 • Lecture 41 : Bode plots-1 • Lecture 42 : Bode plots-2

Week 8: Lecture 43 : Bode plots-3 • Lecture 44 : Op-amp filters • Lecture 45 : Simulation of op-amp filter
Lecture 46 : Precision rectifiers-1 • Lecture 47 : Precision rectifiers-2 • Lecture 48 : Precision rectifiers-3

Week 9: Lecture 49 : Simulation of triangle-to-sine converter • Lecture 50 : Schmitt triggers-1 • Lecture 51 : Schmitt triggers-2
Lecture 52 : Schmitt triggers-3 • Lecture 53 : Sinusoidal oscillators-1 • Lecture 54 : Sinusoidal oscillators-2

Week 10: Lecture 55 : Introduction to digital circuits • Lecture 56 : Boolean algebra • Lecture 57 : Karnaugh maps
Lecture 58 : Combinatorial circuits-1 • Lecture 59 : Combinatorial circuits-2 • Lecture 60 : Combinatorial circuits-3

Week 11: Lecture 61 : Introduction to sequential circuits • Lecture 62 : Latch and flip-flop • Lecture 63 : JK flip-flop
Lecture 64 : D flip-flop • Lecture 65 : Shift registers • Lecture 66 : Counters-1

Week 12: Lecture 67 : Counters-2 • Lecture 68 : Simulation of a synchronous counter • Lecture 69 : 555 timer
Lecture 70 : Digital-to-analog conversion-1 • Lecture 71 : Digital-to-analog conversion-2
Lecture 72 : Analog-to-digital conversion