

EE344 – Electronic Design Lab (EDL)

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EE 344	Electronics Design Lab	1	0	4	6

← EE344: ELECTRONIC DESIGN LAB

Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system Design, Interfacing of analog and digital systems, Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations. Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application will be carried out.

Text/References

- A. S Sedra and KC Smith, Microelectronic circuits, 5th edition, Oxford University Press, 2007.
- P. Horowitz and W Hill, The Art of Electronics, 2nd Edition, Cambridge University Press, 1997.
- H.W.Ott, Noise Reduction Techniques in Electronic Systems, Wiley, 1989.
- W.C. Bosshart, Printed Circuit Boards: Design and Technology, Tata McGraw Hill, 1983.
- G.L. Ginsberg, Printed Circuit Design, McGraw Hill, 1991.

EE 344 EDL - Uniqueness

- **Structured labs vs non-structured**

- In other EE labs you are given a set of experiments. Everything is 'done' for you.
- In EDL nothing is done for you. Instead, you should 'design' circuits and other sub systems as per your requirement
- Analysis vs Design
- In EDL you will need skills to decide what circuit/component to choose when
- You will learn a lot about measurements and their interpretation
- You will be judged based on the final outcome (final product/prototype) which works reliably
- You need to do meticulous planning – dividing tasks among group members, sub system design, testing, integration

- How is a product/implementation different from an idea?

- You are fully in control of your project right from the beginning
- We don't interfere as long as you are making progress as per your original plan
- Here is one course where you are able to use your creativity and imagination into useful gadgets

Skills Required

- Electronic design – component and circuits to choose from, interfacing, power supply constraints
- Documentation – writing down design steps and measurement results
- Planning – week wise task per person; charting progress
- PCB design and testing
- Prototyping and putting everything in a box to give the look of a product/gadget

Skills required in an Electronic Design

- Understanding the User Specs and requirements
- Knowledge of the different solutions for the sub-systems
- Choosing the correct solutions – based on both cost and performance
- Thorough Literature Survey – of other/similar solutions
- Coming up with a proper Block Diagram with interconnection between the sub-blocks
- Project Planning – time chart with individual tasks
- Testing of the Sub-blocks

- The available budget for a project is typically Rs 2000 to 4000

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EDL Projects

- Need to be chosen carefully – do not choose fancy/hobby projects
- Software alone projects not allowed

- Questions to be asked
 - Does it have sufficient (50 – 70%) Electronic design and hardware implementation?
 - Does it have enough sub-systems which needs design and implementation, or are most of your sub-systems bought out items?
 - Does it require the use of some specialized equipment all the time, or will you be able to do your project in the WEL Lab most of the time?
 - Will you be able to demonstrate sufficient progress every month?
 - Is it doable in about 15 weeks?
 - Does it have too much of mechanical fabrication (eg. Robotics)?

2019 – Proj Topics

- 20 MBps Polymer Optical Fiber (POF) link with Bit Error Rate Tester (BERT) - JJ
- Digitally Controlled Analog Computer (MC)
- Accumulator management system (KT)
- Intelligent Power Socket (JJ)
- Coconut to Copra Non Invasive Yield Estimation (ST)
- IRNSS FRONT END RECEIVER (SG)
- SMART DUSTBIN SYSTEM (KT)
- Impedance Measurement System (PM)

- Solar based LED Emergency light (JJ)
- Centrifugal Microfluidic Disk based Biosensing platform (ST)
- Engine Oil Quality Check (JJ)
- Smart Solar Saver (JJ)
- Honk Free Roads (PM)
- 50Mbps POF Link (Laser Diode)-(AK/JJ)
- Phototaxis using spiking neural network (UG)
- Wireless Video transmission (SG)
- Automatic characterization of Solar Cell (JJ)
- Solar based LED Emergency light (JJ)
- Centrifugal Microfluidic Disk based Biosensing platform (ST)

- RS-422 Link (JJ)
- High Efficiency, High Fidelity Modulated Power Audio Amplifier (MC)
- NIXIE TUBE CLOCK DISPLAY (MC)
- NON-INVASIVE GLUCOMETER (SG)
- GPR Noise Removal (SG)
- Discrete Analog to Digital Converter (PM)
- SMART SOLAR FLOODLIGHT (JJ)

2018 – Proj Topics

- Rotating LED Display with Wireless data input
- Dig Controlled Analog Computer
- Design of High Freq Osc
- Sync Vibration Sensors
- Barcode Scanner
- IRNSS
- Photoplethysmogram (PPG)
- Wireless Mobile Charging
- Temp and Humidity Control
- Smart Shoe
- Intelligent Power Socket
- Mobile Charging – Solar + Vibrations
- 2 Mbps Polymer Optical Fiber Link

Tentative Tutorial Topics

- CRO – CRO probes – (Jan 10 Fri)
- Power Supply – Unreg supply – single supply, dual supply, Capacitor filter; Zener regulators; Adjustable and fixed voltage regulators.
- BJT interfacing circuits; TTL NOT gate; TTL families; CMOS inverter; Fan-out and CMOS-TTL interfacing; Open-collector gates.
- Relays and their interfacing
- Opamps – Inv amp, Non-inv amp, Diff Amp; Freq Compensation
- Opamp based interfacing circuits
- Sensors –
- Noise considerations
- PCB design – Eagle – Jan end
- Prototyping
- RF design

Course Schedule

- Venue
 - WEL-1 Lab
- B.Tech students
 - Slot L1 (Mon 2-4:30 pm) and Slot L3 (Thu 2- 4:30 pm)
- DD Students
 - Slot L2 (Tue 2-4:30 pm) and Slot L4 (Fri 2- 4:30 pm)

Tutorial and Quiz

- Tutorial : 4-4:30pm on Mondays and Thursdays
- Short Quiz : 2:00-2:20 on Thursdays and Fridays

Expectations

- ATTENDANCE: Reach WEL-1 Lab at least 5 min before 2 pm.
Late comers will be penalized
 - Devote full time on your project. Divide the work between your partners
- DOCUMENTATION
 - Each member should have his/her own INDIVIDUAL 200 pages note books exclusively for EDL.
 - Make good documentation on your progress – including problems faced, solutions, ...
 - Be sure to record your design, circuit diagram, test results, comments and other details in your note book.

EDL Groups and Project

- Groups of THREE (four member group may be allowed for larger projects)
- Choose Project Partners from your section (i.e. B.Tech or DD) – latest by Jan 16/17.
- Project topics to be frozen preferably by Jan 23rd /24th
- Need to submit your proposals latest by Jan end.

Weightage

- **Quiz – 20% (Every week)**
- **Project – 80%**
 - Project Proposal – 10%
 - Eval – 1 (Feb, just before Midsem; Mentor Fac + another EE Faculty) – 10%
 - Eval – 2 (March, 10%) – Presentation + Mentor Feedback
 - Final Evaluation
 - Presentation + Demo – 50% (=10% + 40%)

EDL Project Evaluations

- Eval – 1 : Week before Midsem (Evaluation mainly on your detailed Project Plan: Faculty Mentor + another EE faculty)
- Eval -2 : Mid March (Presentation)
- Proj Presentations: Mid/3rd week of April
- Final Demo : Last week of April (Just before Endsem)

- Questions?