Introduction to Electronics -- 2019-20-I.

ESc 201A

Lecture 1: Introduction and History

Theory Instructor:

Dr. Utpal Das

Office: ACES-228

Phone: 7150

Email: utpal@iitk.ac.in

Laboratory Instructor:

Dr. K. S. Venkatesh

Office: ACES 207

Phone: 7468

Email: venkats@iitk.ac.in

Course Schedule:

Lecture – M, W, F - 8:00-8:50 - L20

Tutorial – Th - 8:00-8:50 – **T103-T112, T203-T206, T211**

Laboratory – M, Tu, W, Th, F – 2:00 – 4:50PM

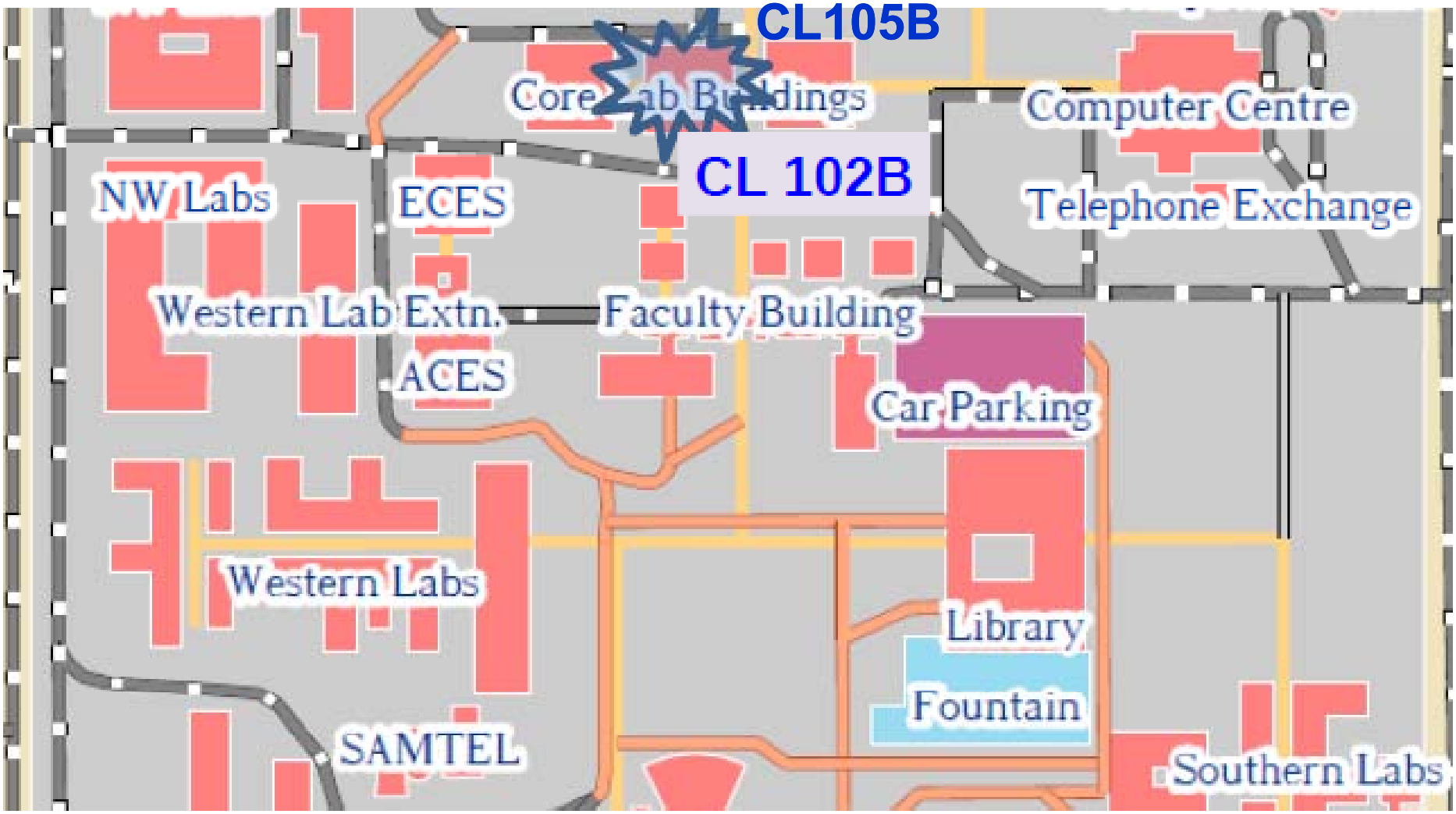
Old Core labs. – CL102B, CL105B

Department of Electrical Engineering, Indian Institute of Technology, Kanpur

http://www.iitk.ac.in/ee/faculty/det_resume/utpal.html

Instructor: Dr. Utpal Das
Office: ACES-228,
Phone: 7150
Email: utpal@iitk.ac.in

Lab Instructor: Dr. K. S. Venkatesh
Office: ACES-207,
Phone: 7468
Email: venkats@iitk.ac.in



ESC 201 A (Lab) TUTORS

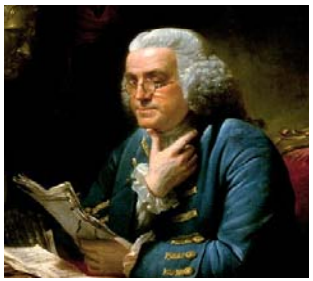
Sec. no.	Tutor	E-mail address
1.	A, Roy	aroy@iitk.ac.in
2.	Ankit Yadav	ankity@iitk.ac.in
3.	Akash Agarwal	akash@iitk.ac.in
4.	G Rajashekhar	gshekhar@iitk.ac.in
5.	Shyam A B	shyamab@iitk.ac.in
6.	Ankur Vishnoi	vishnoi@iitk.ac.in
7.	Shilpi Gupta	shilpi@iitk.ac.in
8.	Ashish Gupta	gashish@iitk.ac.in
9.	Akhilesh Prakash Gupta	apgupta@iitk.ac.in
10.	Rajesh Hegde	rhedge@iitk.ac.in
11.	Shivani Singh	shivanis@iitk.ac.in
12.	Badri Patro	badri@iitk.ac.in
13.	N. K. Vermas	nischal@iitk.ac.in
14.	Vinod Kumar Kurmi	vinodkk@iitk.ac.in
15.	A. Roy	aroy@iitk.ac.in

ESC 201 A (Tut) TUTORS

Sec. no.	Tutorial Rm	Tutor	E-mail address
1.	T103	A. Roy	aroy@iitk.ac.in
2.	T104	Ankit Yadav	ankity@iitk.ac.in
3.	T105	Akash Agarwal	akash@iitk.ac.in
4.	T106	G Rajashekhar	gshekhar@iitk.ac.in
5.	T107	Shyam A B	shyamab@iitk.ac.in
6.	T108	Ankur Vishnoi	vishnoi@iitk.ac.in
7.	T109	Shilpi Gupta	shilpi@iitk.ac.in
8.	T110	Ashish Gupta	gashish@iitk.ac.in
9.	T111	Akhilesh Prakash Gupta	apgupta@iitk.ac.in
10.	T112	Rajesh Hegde	rhedge@iitk.ac.in
11.	T203	Shivani Singh	shivanis@iitk.ac.in
12.	T204	Badri Patro	badri@iitk.ac.in
13.	T205	N. K. Vermas	nischal@iitk.ac.in
14.	T206	Vinod Kumar Kurmi	vinodkk@iitk.ac.in
15.	T211	A. Roy	aroy@iitk.ac.in

In ~300yrs. history of electricity, no single defining moment exists.

Over 2,000 years ago, Greeks found that amber rubbed with fur attracts light objects, i.e. dust/feathers. Two rubbed amber rods were found to repel each other.



Benjamin Franklin (1706-1790) discovered electricity with his famous kite-flying experiments in 1752.

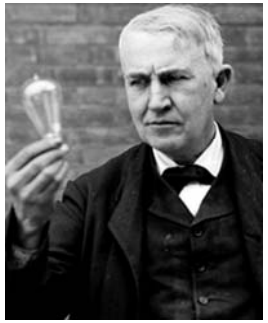
Alessandro Giuseppe Antonio Anastasio Volta 1745-1827, invented the electric battery.

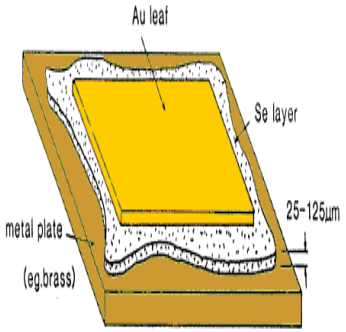
Electric light bulb: Joseph Swan a physicist and chemist in 1850 began working with carbonized paper filaments in an evacuated glass bulb. By 1860 demonstrated a working device. **Thomas Edison 1878**.

Vacuum Diode (John A. Fleming 1849–1945) in 1904 1st vacuum tube.

1873, F. Guthrie 1st diode effect

1875 Selenium Diode: Photoelectric & Rectifying propert. of **Selenium** were also observed by **W. G. Adams and R. E. Day** in 1876, **F. Braun 1876, and C. E. Fitts** ~1886.



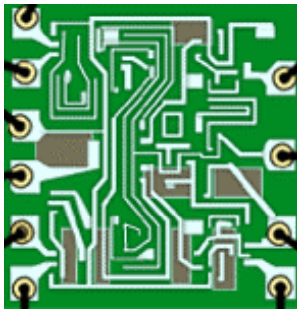


1901, J. C. Bose: Galena crystal point-contact semicon d. diode

A Short History Of Semiconductor Electronics

Crystal detector, used in early wireless radios. This device (patented by a German scientist, Ferdinand Braun, in 1899) was made of a single metal wire touching against a semiconductor crystal. The result was a rectifying diode (so called because it has two terminals), which lets current through easily one way, but hinders flow the other way

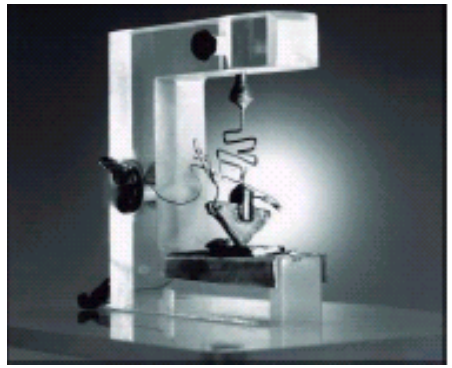
1906	First Silicon Diode	Triode (Lee De Forrest)
1927		Long distance telephone (AT&T)
1935	Commercial selenium rectifiers and photodiodes	
1946		Mini vacuum tubes
		ENIAC - First computer



1947 First transistor - ATT Bell Laboratories **Nobel Prize in 1956**

John Bardeen,
William Shockley,
Walter Brattain,

The first germanium bipolar transistor.

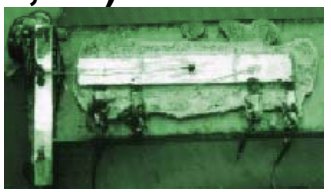


1949 Single crystal transistor (Gordon Teal)

1950 1st Junction Transistor :Shockley, Morgan, Sparks, and Teal

1951 Production of point contact transistors(Westinghouse, Allentown,PA)

1954 Silicon junction transistor (Texas Instruments)



1958 Integrated Circuit - Jack Kilby (Texas Instruments)

1959 Commercial IC (Fairchild Semiconductors) Robert Noyce

1966 First MOSFET by Attala and Khang,

1968 Founding of INTEL(Gordon Moore and Robert Noyce)

1971 Microprocessor (INTEL)

1978 APPLE 2 (MOTOROLA)

1981 IBM PC

Nobel Prize in 2000

Zhores Alferov

Jack Kilby

Herbert Kroemer

2004 Onwards Quantum Dots

Nanotechnology: Single Electron Transistors.

Acknowledgements:

- Prof. Baquer Mazhari, EE department
- Prof. A. R. Harish, EE department
- Prof. S.S.K. Iyer, EE Department
- Prof. Yogesh Singh Chauhan, EE Department
- Prof. A. Banerjee, EE department
- Prof. K. V. Srivastava, EE Department
- Prof. Pradeek Kumar, EE Department
- Prof. Shilpi Gupta, EE Department
- Prof. Ketan Rajawat, EE Department
- Prof. Aloke Dutta , EE Department
- Prof. Gannavarpu Rajshekhar , EE Department

Topics	Approx. No. of Lectures
Circuit Analysis Techniques: Nodal, Mesh, Superposition, Thevenin, Norton	5
Transient Analysis of RL and RC Circuits	2
Sinusoidal Steady State Analysis	3
Transfer Function and Frequency Response	3
Semiconductors, Diodes and diode Circuits	4
Transistors and Amplifiers	4
Operational Amplifiers and waveform Generation	5
Numbering system, logic gates, Combinational circuits	4
Flip-flops, Sequential Circuit Design	5
Data Converters	2

Tutorials: T103, T104, T105, T106, T107, T108, T109, T110, T111, T112, T203, T204, T205, T206, T211.

1. Homework Assignment sheets will be given every week.
2. For proper learning it is expected that you would attempt to solve all the problems prior to tutorial.
3. You are ***not*** *required to submit homework solutions.*
4. During the *first 10 minutes of the tutorial, you would be* asked to solve a problem related to the homework assignment, which will be graded and used in tutorial assessment.
5. Solutions to homework assignments will be discussed during tutorials.
6. Solutions will also be posted on ESc201 website.

GRADING

S.No.	Descripton	Marks
1.	Tutorial mini-quizzes (10-minutes)	20
2.	Three major-quizzes (45 minutes each, Best two to be only considered)	20(30)
3.	One Mid-Semester Examination	50
4.	One End-Semester Examination	70
5.	One Laboratory Examination	20
6.	Weekly Laboratory Performance	20
	Total	200

Policy Regarding Missed Examinations/Laboratory Sessions

If you miss an examination due to approved medical leave or you have your leave approved by the competent authority at IIT Kanpur, following policy will be applied.

1. **Missed mini-quizzes (10 minutes): No make-up examination.**
2. **Missed major Quiz-1/Quiz-2/Quiz-3: No make-up examination.**
3. **Missed lab examination: No make-up examination. Check with laboratory Instructor (Dr. K. Venkatesh).**
4. **Missed End-semester examination: You will be allowed to take the** make-up examination **subject to Institute guidelines. It is your** responsibility to contact the instructor (Dr. U. Das, e-mail: utpal@iitk.ac.in) for the make-up examination. If you fail to appear in the make-up examination, you will be awarded zero marks.
5. **Missed Laboratory sessions: You will be allowed to complete the** experiment in the designated make-up laboratory sessions. However, if you do not appear in the makeup laboratory sessions, you will be awarded zero marks for that experiment.

Examination Schedule

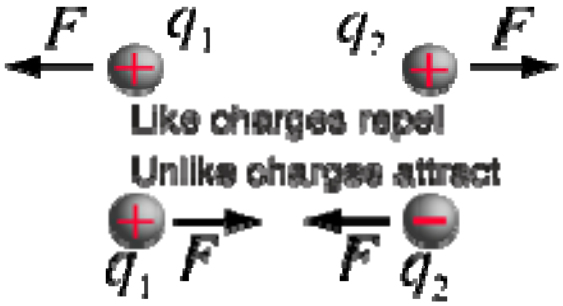
- **Tutorial mini-Quiz (10 minutes) every Thursday in the first 10 minutes of the tutorial.**
- **1st Major Quiz: Tuesday, Sept. 05, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.**
- **Mid-semester examination: Week of Sept. 16-21, 2019**
- **2nd Major Quiz: Tuesday, Oct. 03, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.**
- **3rd Major Quiz: Saturday, Oct. 31, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.**
- **Laboratory Examination: Week of Apr 17-21, 2019**
- **End-semester Examination: Week of Nov. 18 – Nov. 27, 2019**

Potential (Voltage) difference is a Source of current flow

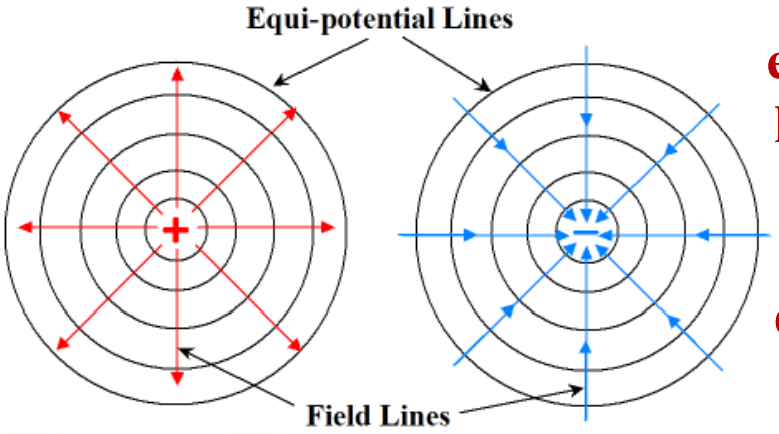
Charge (q): **– Elementary charge particle: *electron***

– Has a negative charge of magnitude q=1.6 x 10^{-19} Coulomb (C) Scalar Quantity

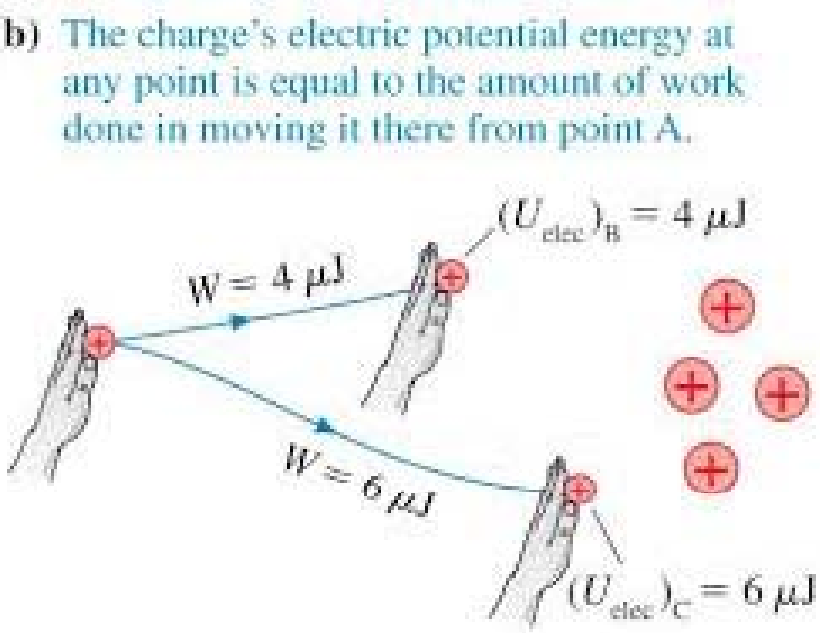
Atoms are neutral. Remove electrons: get +positive charge. Assume that Charges cannot be created or desytroyed



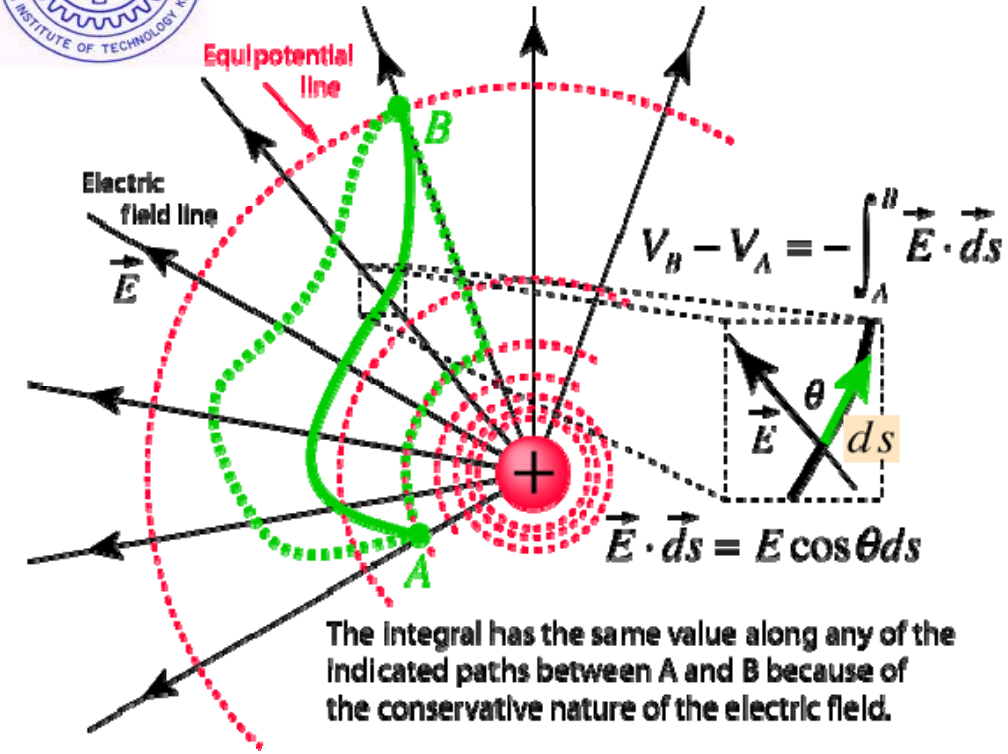
$$F = \frac{kq_1q_2}{r^2} = \frac{q_1q_2}{4\pi\varepsilon_0 r^2}$$ *Coulomb's Law*

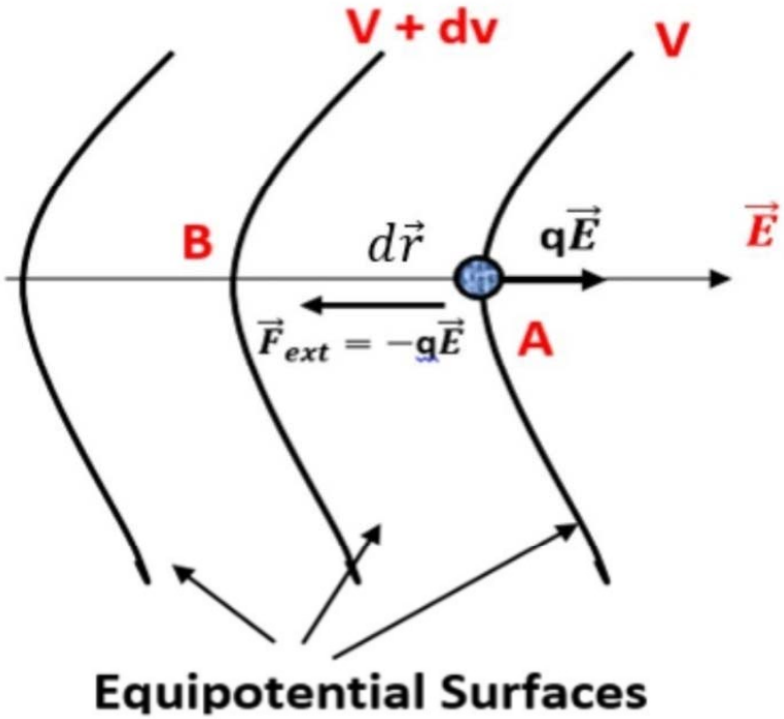


Along equipotential line no work done. Needs potential difference to do work.



Potential (Voltage) difference.





Voltage (V) (also referred to as potential):

– Work done (or energy spent) to move a unit charge between two points.

– (work done)/(unit charge) => 1 V = 1 J/1 C

– Also, known as the *potential difference (p. d.)* between two points, expressed in Volt.

There would be no Laboratory this week.

Tutorial on Th, Aug. 01 will not be held, instead, the tutorial is being converted to a regular class in the same L20

Reference Books:

Foundations of Analog and Digital Electronic Circuits: Anant Agarwal and Jeffrey H. Lang, Dept. of EECS, MIT, Cambridge, MA, USA, Elsevier.

Engineering Circuit Analysis : W. Hayt, J. E. Kemmerly and S. M. Durbin, TATA McGraw Hill.

Digital Design : M. M. Mano, Ciletti, 4th edition, Pearson

Digital Principles and Applications: A.P. Malvino, D.P. Leach, 5th edition, Tata McGraw Hilll.