

*The first semester examinations under CCF are to be held for the first time this year. Consequently, first semester students have no way to refer to past years' examination question papers. Pursuant to requests from them, the department has taken the initiative to provide sets of questions on different topics to help them prepare for the exams. However, students must note that the questions are just indicative of the type they may expect in their final exam and they must go through the syllabus thoroughly and in its entirety to be able to perform well. Many if not all the relevant topics have already been discussed in the class. Students still having doubts and queries must feel free to ask their teachers in the class or through WhatsApp or Google classroom*

**Question Bank (with relevant links):**

**For first semester CCF Major/Minor/MDC students:**

**ELT-H-CC-1-1-TH (DSCC-1): Fundamentals of Circuit Theory and Electronic Devices**

**UNIT I:**

**Electric Circuit Elements:**

Short questions on Electric circuit elements.  
Name a few different types of resistors.  
What is meant by resistor colour code? [Resistor colour codes](#)  
Find the value of resistance for a given specific colour code.

Similar short questions on capacitors and inductors.  
Capacitor colour codes [Capacitor colour codes](#)

What is meant by self and mutual inductance? [Self and Mutual Inductance](#)  
What is the working principle of a transformer? [Transformer basics](#)

**Circuit Analysis:**

What do you mean by ideal and practical voltage and current sources? [Voltage and Current sources](#)

How do you convert a Voltage source to a Current source? [Conversion of Voltage source to Current source](#)

What do you mean by mesh and node analysis? Simple problems.

[Node analysis](#)  
[Mesh analysis](#)  
[Mesh and Node analysis](#)  
[Circuit analysis](#)

What are star and delta networks? How can you convert one to another (conversion formulae)? [Star Delta conversion](#)

**DC Analysis:**

What do you mean by transient response in an electric circuit?  
Obtain the expression for the transient charge for a series RC circuit excited by a dc source. Draw the graphs showing the variation of the charge on the capacitor, voltage across the capacitor, voltage across the resistor and current with time. Define time constant of the circuit.  
Obtain the expression for the transient current for a series RL circuit excited by a dc source. Draw the graphs showing the variation of the current, voltage across the resistor and voltage across the inductor with time. Define time-constant of the circuit.  
[Transient analysis](#)

**AC Analysis:**

What is a series resonant circuit? Obtain the expression for current in a series resonant circuit in terms of the source voltage and impedance of the circuit.  
Draw the variation of current and impedance with frequency in a series resonant circuit.  
Define resonant frequency, bandwidth, half-power frequencies, Q value and voltage magnification for such a circuit.  
Why is series resonant circuit called an acceptor circuit?  
[LCR Series resonance](#)  
[LCR Series resonance](#)

What is a parallel resonant circuit? Draw the variation of current and impedance with frequency in a parallel resonant circuit. Why is parallel resonant circuit called a rejector circuit?  
[LCR parallel resonance](#)

**Network Theorems:**

Statement of all the network theorems included in the syllabus. Proof of maximum power transfer theorem. Simple problems related to finding any voltage and current in a given circuit using any of the network theorems.  
[Network theorems](#)

**UNIT II:**

**Semiconductor Basics:**

What are energy bands in a solid? Distinguish insulators, semiconductors and metals (or conductors) with the help of energy band diagrams.

What are intrinsic (or pure) semiconductors? What are extrinsic (or impure or doped) semiconductors. Give examples. What are p-type and n-type semiconductors? Give examples.

What is effective mass? How can you obtain its value from the E-k diagram?

What are direct and indirect band semiconductors. Give examples.

[Direct and indirect band semiconductors](#)

What is meant by density of states?  
[density of states](#)

Write down the expression for the Fermi distribution function f(E). Draw the graph of f(E) versus E for T=0K and T>0K. Define Fermi level.  
Write the expressions for the number of electrons in the conduction band and the valency band in a semiconductor.  
Write down the expression for the Energy gap (E<sub>g</sub>) in a semiconductor.  
[semiconductor basics](#)

What is the position of the Fermi level in an intrinsic semiconductor, an n-type semiconductor, a p-type semiconductor and a degenerate semiconductor?

What are the two mechanisms of current flow in a semiconductor? Define drift velocity, mobility, current density and conductivity.

What is Hall effect? What is meant by Hall voltage? (No derivations needed as per syllabus) [https://www.tf.uni-\[Hall effect basics\]\(#\)](https://www.tf.uni-Hall%20effect%20basics)

**Junction Diode and Its Applications:**

What is a depletion region in a p-n junction and how is it formed? Draw the energy band diagram of an unbiased, a forward biased and a reverse biased p-n junction.  
[physics behind p-n junction and p-n diode](#)

Write down Shockley's equation for a p-n diode. Draw the I-V characteristic for a forward and reverse biased diode. What is reverse saturation current (I<sub>s</sub>)? How does the I-V characteristic and I<sub>s</sub> change with temperature?  
[Basic diode theory](#)  
[Temperaure dependence of diode characteristic](#)  
Define static (dc) and dynamic (ac) resistance of a diode from the I-V characteristic. Draw the piecewise linear approximation of an ideal and a practical diode.  
[Piecewise linear approximation of a p-n diode](#)

Differentiate between zener and avalanche breakdown. How is the reverse characteristic of a Zener diode different from an ordinary p-n diode?  
What is meant by laod and line regulation?  
Explain with the help of relevant circuits and the waveforms, the working of a half-wave and a full-wave rectifier.  
Draw the block diagram of a DC power supply. What is the use of a filter circuit? Define the terms ripple factor and efficiency.  
[Basic electronics](#)

**UNIT III:**

**Bipolar Junction Transistor:**

What are the current components in a BJT. Write the relation between them. Define ICBO and ICEO. Define alpha and beta and obtain their relationship.

Draw the circuit diagram to study the input and output characteristics of an npn or pnp BJT in CB or CE mode. What is meant by cut-off, saturation and active regions in the output characteristic diagram? What is early effect and how does it explain the nature of the characteristics?

**Transistor Biasing:**

What is transistor biasing? What is meant by the Q point? Define the stability factors. What is thermal runaway?  
[BJT stability and biasing](#)  
Draw the circuits for fixed bias, collector to base bias and voltage divider bias.  
[BJT biasing methods](#)

**UNIT IV**

**BJT Amplifiers:**

What are r parameters? Define the four hybrid (h) parameters?  
[transistor parameters](#)

Draw the h-parameter BJT equivalent circuit for a single stage CE amplifier. Obtain the expressions for the input impedance, output impedance, voltage gain and current gain.  
[h-parameter equivalent circuit 1](#)  
[h-parameter equivalent circuit 2](#)  
[h-parameter equivalent circuit 3](#)

What are class A, class B, class AB and Class C amplifiers?  
[Power amplifiers 1](#)  
[Power amplifiers 2](#)

**Field Effect Transistor:**

What does JFET and MOSFET stand for? Draw the circuit to study the characteristics of an n channel JFET? Draw the output and transfer characteristics of an n channel JFET. What is pinch off voltage? Name the FET parameters and their relationship.  
[JFET output and transfer characteristics](#)  
[FET parameters](#)