

Unit 14 - Week 12

Course outline

How does an NPTEL online course work?

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Week 12

- LCD/AMOLED Display Drivers - Part 1
- LCD/AMOLED Display Drivers - Part 2
- LCD/AMOLED Display Drivers - Part 3
- LED Drivers for Camera Flash
- Li-Ion Battery and its Charging Phases
- Battery Charger IC
- Quiz : Assignment 12**
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Assignment solutions

Assignment 12

The due date for submitting this assignment has passed. **Due on 2020-04-22, 23:59 IST.**
 As per our records you have not submitted this assignment.

- State whether the following statement is true or false. "The LCD structure contains fewer layers than the AMOLED structure." **1 point**
 - True
 - False

No, the answer is incorrect.
Score: 0
Accepted Answers:
 False
- State whether the following statement is true or false. "The voltage that is applied across the LCD electrodes controls the alignment of the liquid crystals and thereby the intensity of light that passes through the LCD structure." **1 point**
 - True
 - False

No, the answer is incorrect.
Score: 0
Accepted Answers:
 True
- State whether the following statement is true or false. "AMOLED displays require a backlight." **1 point**
 - True
 - False

No, the answer is incorrect.
Score: 0
Accepted Answers:
 False

Consider the charge pump shown in Figure 1, for questions 4 to 7. It is used to generate the AVEE power supply voltage for a Liquid Crystal Display (LCD). ϕ_1 and ϕ_2 are complementary, non-overlapped clock phases, as shown in Figure 1. C_{fly} and C_{out} are initially discharged at time $t = 0$ (i.e. zero initial voltage across C_{fly} and C_{out} at $t = 0$). Assume that $AVDD = 5.5\text{ V}$ and that $C_{fly} = 2C_{out}$. Use information provided / obtained in a previous question to answer subsequent questions. Adhere to the units mentioned in the question while filling in numerical answers.

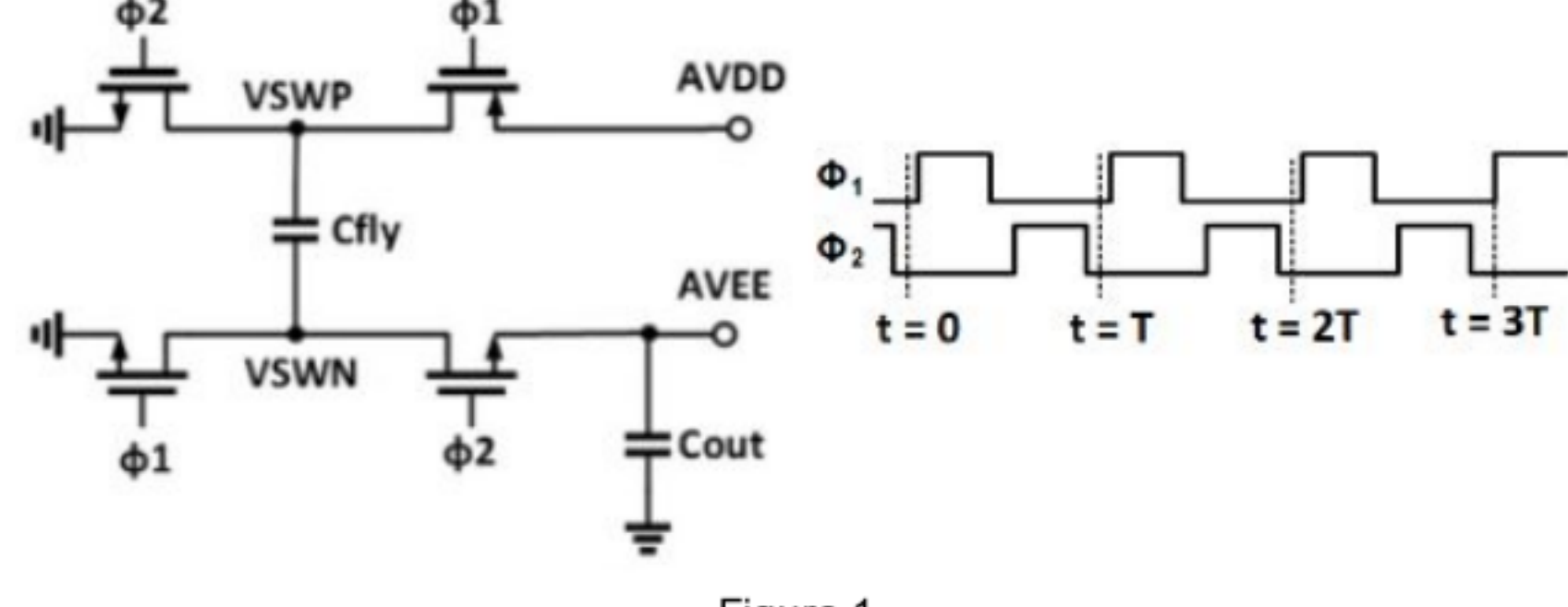


Figure 1

- Fill in the blank with a numerical answer: The value of the node voltage AVEE at time $t = T$, is ____ volt (up to 2 decimal places). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Range) -3.67,-3.65
- Fill in the blank with a numerical answer: The value of the node voltage AVEE at time $t = 2T$, is ____ volt (up to 2 decimal places). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Range) -4.89,-4.87
- Fill in the blank with a numerical answer: The value of the node voltage AVEE at time $t = 3T$, is ____ volt (up to 2 decimal places). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Range) -5.30,-5.28
- Fill in the blank with a numerical answer: The steady-state value of the node voltage AVEE, is ____ volt (up to 1 decimal place). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Numeric) -5.5

Consider the switching converter shown in Figure 2, which supplies power to a string of LEDs (which serves as an LCD backlight) for questions 8 and 9. Use information provided / obtained in a previous question to answer subsequent questions. The duty cycle D always lies between 0 and 1. Adhere to the units mentioned in the question while filling in numerical answers.

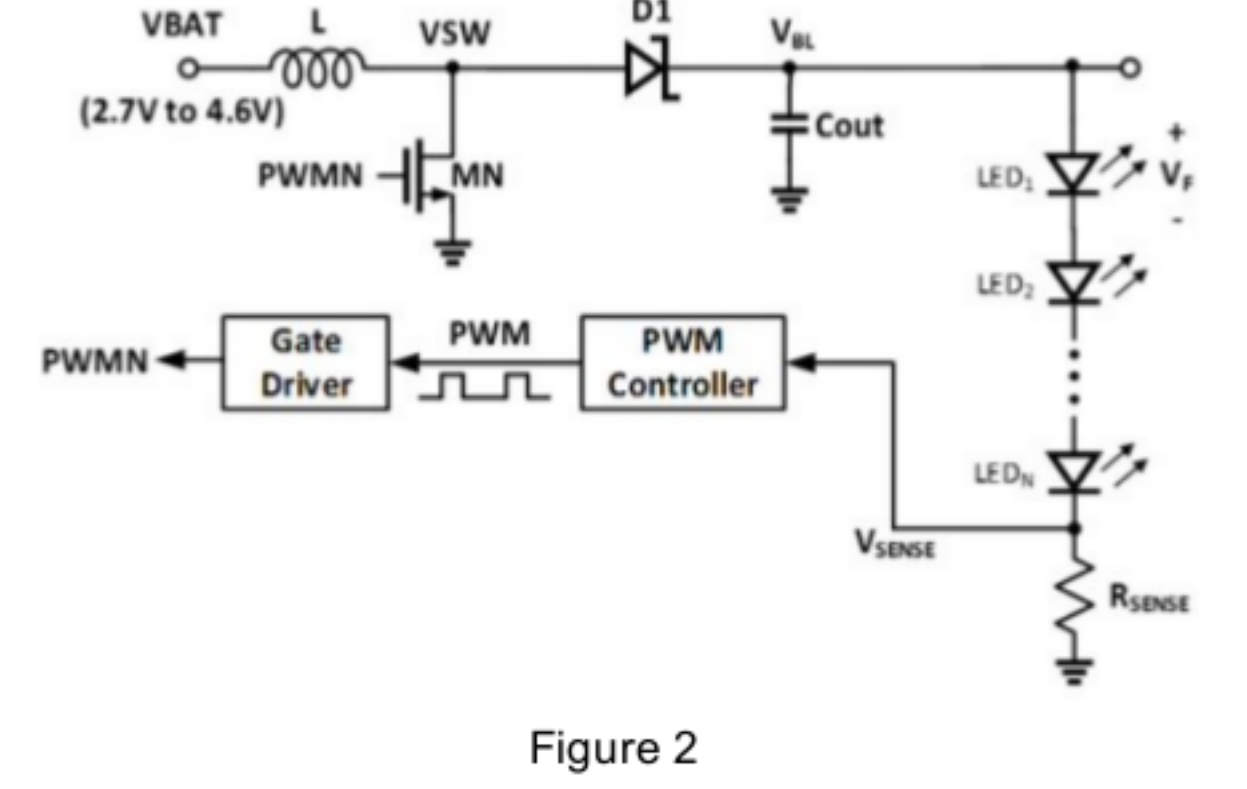


Figure 2

- Fill in the blank with a numerical answer: Given that $R_{SENSE} = 20\ \Omega$, the number of LEDs in the string is $N = 6$ and that the LED forward voltage is $V_f = 3.5\text{ V}$ with a current of 30 mA flowing through the LEDs, the converter regulates its output at a backlight supply voltage $V_{BL} =$ ____ volt (up to 1 decimal place). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Numeric) 21.6
- Fill in the blank with a numerical answer: Ignoring all losses in the converter and assuming that diode D_1 has zero forward voltage, the duty cycle of PWMN when the battery voltage is $V_{BAT} = 4.2\text{ V}$, is ____ (up to 2 decimal places). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Range) 0.79,0.82
- State whether the following statement is true or false. "The AMOLED power supply rail VNEG is kept constant to reduce OLED flicker while VPOS is varied as appropriate, to improve the efficiency." **1 point**
 - True
 - False

No, the answer is incorrect.
Score: 0
Accepted Answers:
 False
- State whether the following statement is true or false. "In smart batteries, the BATID terminal is used for serial communication via the MIPI battery interface standard." **1 point**
 - True
 - False

No, the answer is incorrect.
Score: 0
Accepted Answers:
 True
- What is the phase in which a lithium-ion battery charges, when it is close to its full voltage? **1 point**
 - Trickle Charge
 - Constant Voltage Charge
 - Pre-Charge
 - Constant Current Charge

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Constant Voltage Charge

Consider the charging profile of a lithium-ion battery, shown in Figure 3, for question 13.

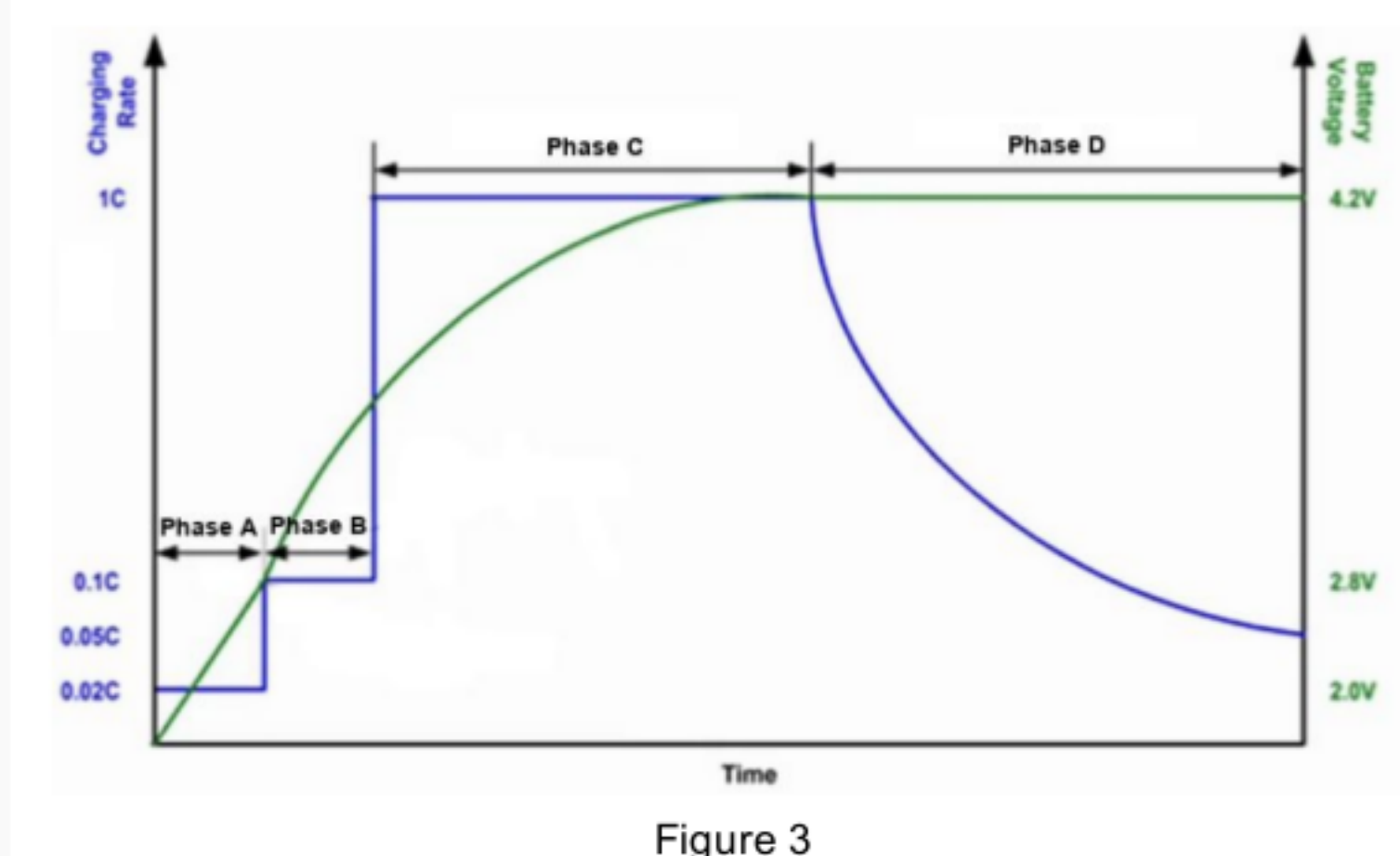


Figure 3

- Match the following four phases with phases A, B, C and D shown in Figure 3.
- I - Constant Voltage Charge, II - Pre-Charge, III - Trickle Charge, IV - Constant Current Charge **1 point**
 - A - I, B - II, C - III, D - IV
 - A - II, B - III, C - IV, D - I
 - A - III, B - II, C - IV, D - I
 - A - III, B - II, C - I, D - IV

No, the answer is incorrect.
Score: 0
Accepted Answers:
 A - III, B - II, C - IV, D - I
 - Consider the discharge curve of a lithium-ion battery, shown in Figure 4, for question 14. The Li-ion battery is operated between $V_{BAT} = 3\text{ V}$ and $V_{BAT} = 4\text{ V}$. Assume that the battery has a capacity of 3000 mAh at $V_{BAT} = 3.5\text{ V}$. Adhere to the units mentioned in the question while filling in a numerical answer. **1 point**

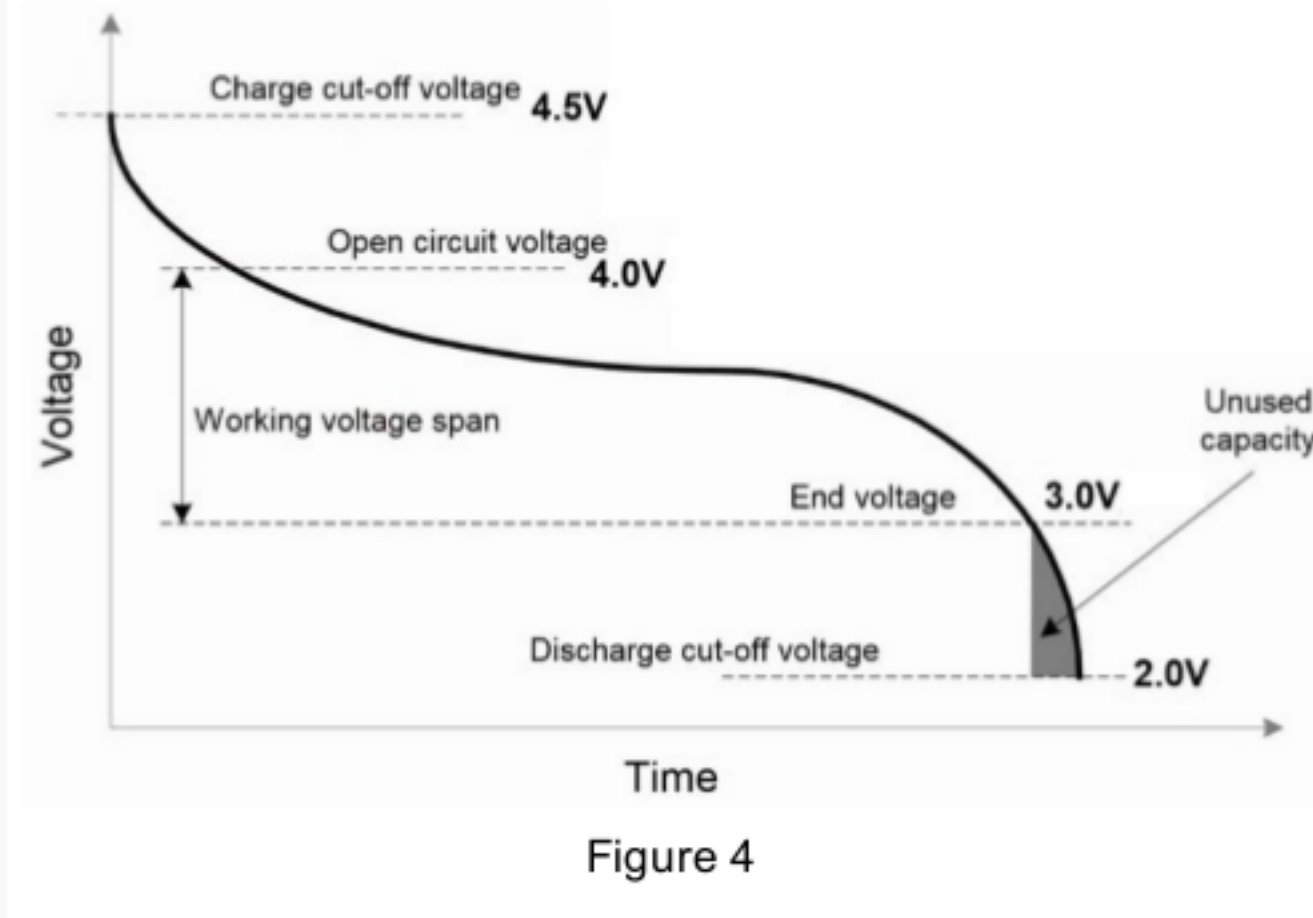


Figure 4

- Fill in the blank with a numerical answer: A switching DC-DC converter has an output voltage of $V_{OUT} = 1.2\text{ V}$ and operates at an efficiency of 80% when it feeds a load of 1 A . Assuming that the Li-ion battery drives the aforementioned DC-DC converter as its load, the battery lasts for ____ hours (up to 1 decimal place). **1 point**

No, the answer is incorrect.
Score: 0
Accepted Answers:
 (Type: Range) 6.9,7.1