Habib University

School of Science & Engineering

Course	EE/CE – 211 – Basic Electronics
Semester	Spring 2024
Assignment	2
Due Date	Feb 26th, 2024
Instructor	Ahmad Usman
Total Marks	50

Name: _____Student ID: _____

Note:

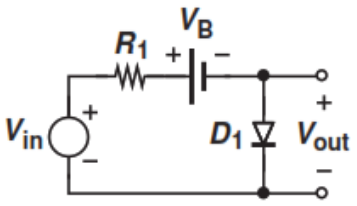
- Take a print of the assignment and solve on the space provided after every question. You can use extra sheets for your answers. Attach them properly.
- No assignment shall be graded if submitted late and don't comply the guidelines as mentioned above.

Course Learning Outcomes
After the completion of the course the student should be able to

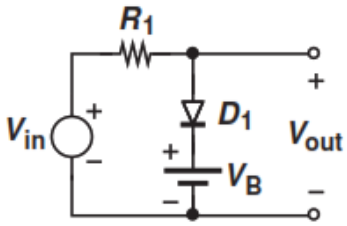
CLOs	Description	Learning-domain level
CLO - 1	Explain and understand the working and behavior of semiconductor diodes, BJTs and MOSFETs in the modern electronic systems.	**Cog – 3**
CLO - 2	Ability to analyze DC and AC the behavior of the semiconductor diodes, BJTs, and MOSFETs in the modern electronic systems.	**Cog – 4**
CLO - 3	Develop an ability to design DC power supplies, DC biasing circuits and single stage amplifier circuits based on the concepts learned pertaining to semiconductor diodes, BJTs, and MOSFETs, for various modern electronic applications.	**Cog – 3**

Question # 1 (CLO – 1, Points: 10, 2 + 2 + 2 + 2 + 2)

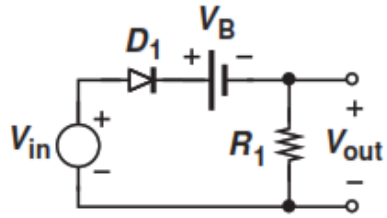
Assuming the input is expressed as $V_{in} = V_0 \cos \omega t$, plot the output of each circuit in the figures shown below. Use an ideal diode model.



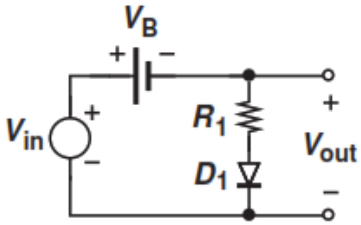
(a)



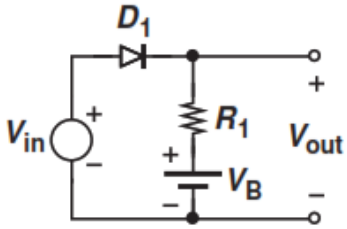
(b)



(c)



(d)

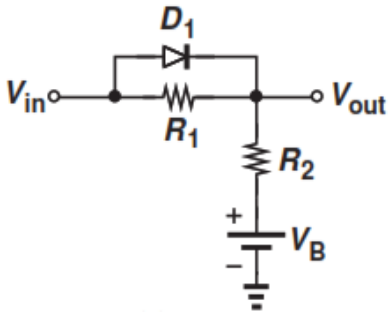


(e)

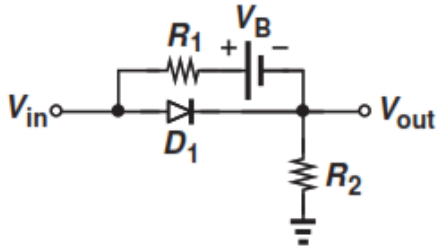
Question # 2 (CLO – 1, Points: 10, 5 +5)

Plot the input/output characteristics for the circuits shown below. Also, plot the currents flowing through R_1 and D_1 as a function of V_{in} for the circuits. Assume a constant-voltage diode model.

(a)

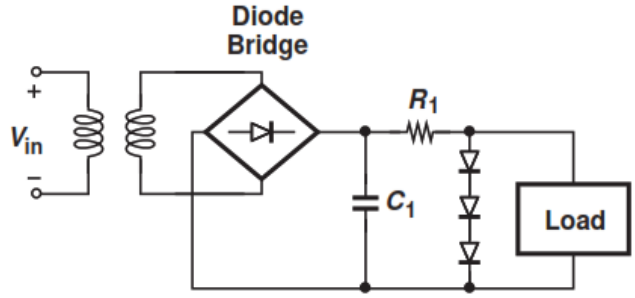


(b)



Question # 3 (CLO – 2, Points: 10, 5 +5)

(a) The diodes carry a current of 5 mA and the load, a current of 20 mA. If the load current increases to 21 mA, what is the change in the total voltage across the three diodes? Assume R_1 is much greater than $3r_d$.



(b) Assuming R_1 carries a relatively constant current and $V_{D,\,ON} = 0.8V$. Estimate the ripple seen across the C_1. Also, using the small-signal model of the diodes, determine the ripple amplitude across the diode. Let $f_{in} = 60$ Hz, $C_1 = 100$ μF, $R_1 = 1$ kΩ, and peak voltage available at the secondary of the transformer is $V_P = 5V$.

Question # 4 (CLO – 3, Points: 20)

You are required to design a full-bridge rectifier-based dc-power supply that provides an average dc output voltage of 15 V. The rectifier feeds a load of 150 Ω. The rectifier is fed from the line voltage of 240V rms, 50 Hz through the primary of a transformer. The allowed maximum ripple is ± 1 % and the available diodes allow 0.7 V drop when operating.

Draw the complete circuit diagram with input and output waveforms. Also, specify the rms voltage that appear across the secondary of the transformer, turn ratio of the transformer, value of the filter capacitor, maximum peak inverse voltage appearing across the diodes and the rating of the diodes, peak diode current, and average current through the diodes during conduction.