ANALOG ELECTRONICS

LECTURE NO. 7

VOLTAGE-MULTIPLIER CIRCUITS

- Voltage-multiplier circuits are employed to maintain a relatively low transformer peak voltage while stepping up the peak output voltage to two, three, four, or more times the peak rectified voltage.

VOLTAGE-MULTIPLIER CIRCUITS

- Voltage Doubler
- Voltage Tripler
- and Quadrupler

VOLTAGE-MULTIPLIER CIRCUITS

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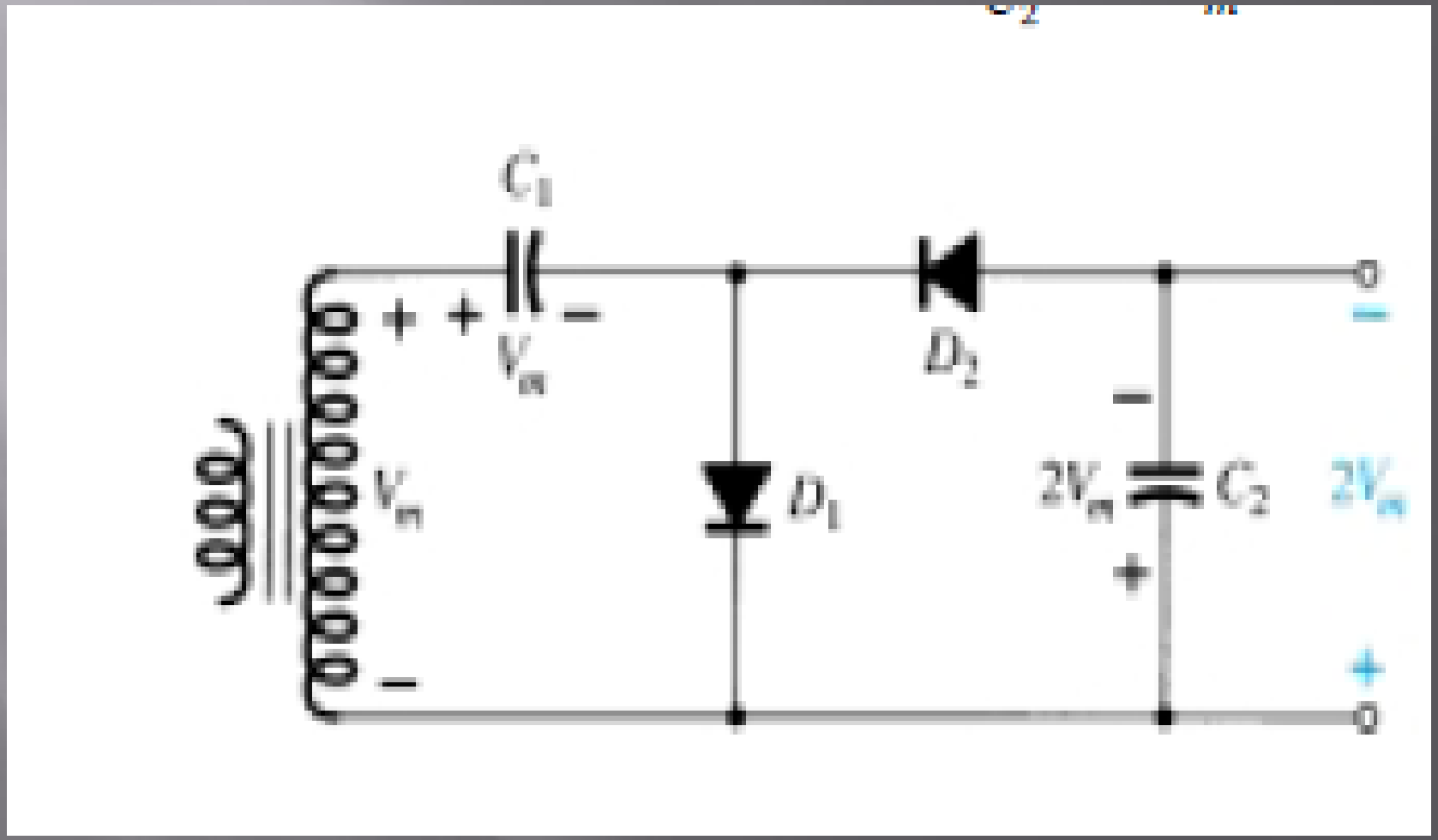
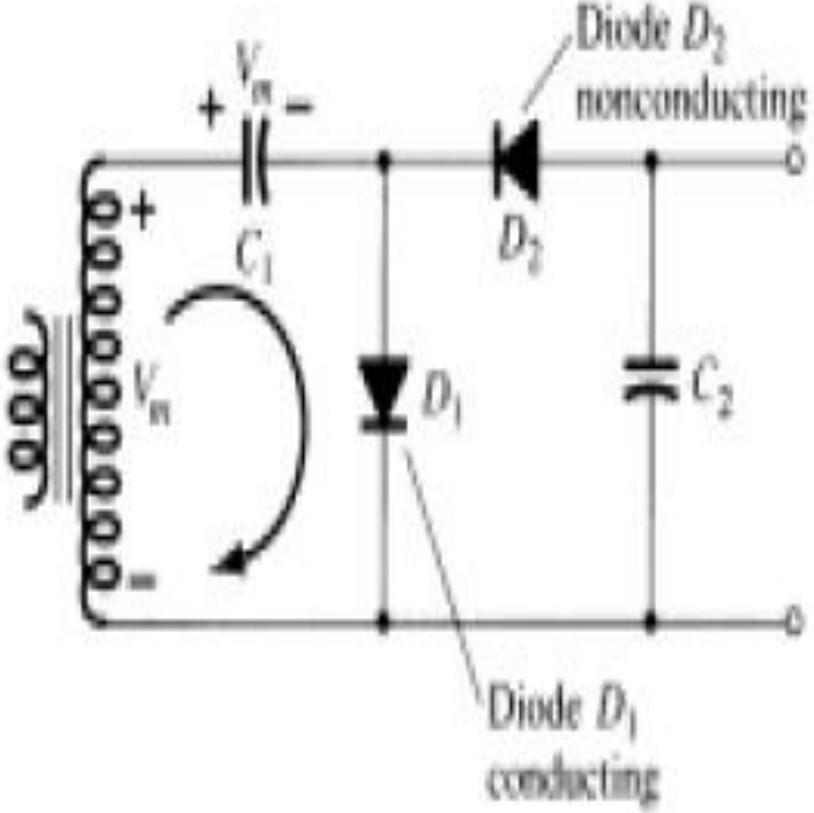
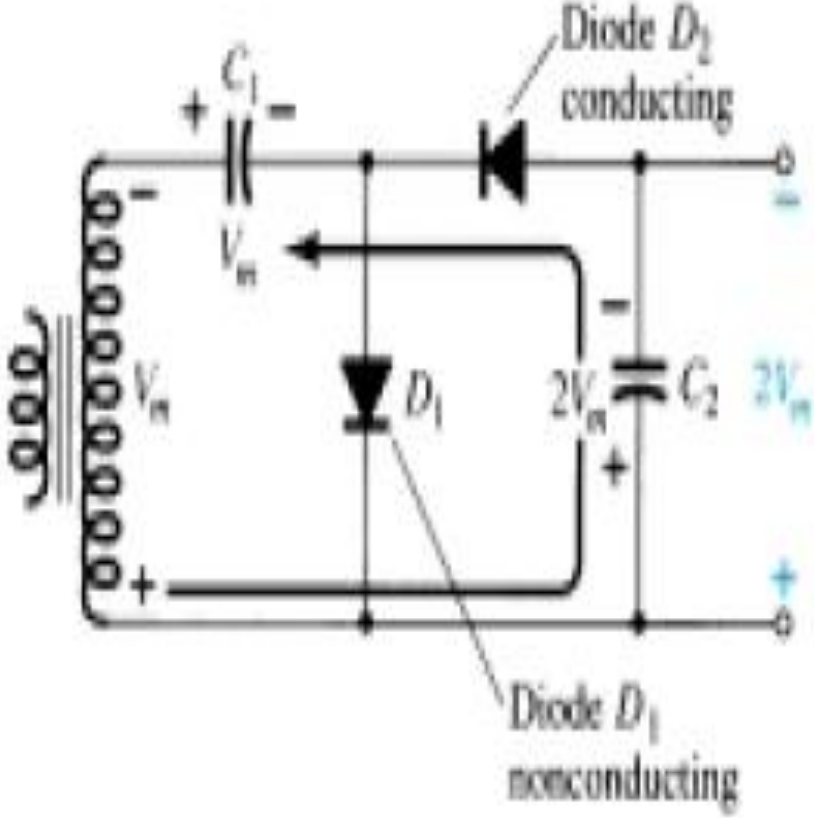
Half wave Doubler circuit




Diode D_2
nonconducting
V_m
C_1
D_2
V_m
D_1
C_2
Diode D_1
conducting

(a)


Diode D_2
conducting
C_1
V_m
V_m
D_1
$2V_m$
C_2
$2V_m$
Diode D_1
nonconducting

(b)

VOLTAGE-MULTIPLIER CIRCUITS

- During the positive voltage half-cycle across the transformer, secondary diode *D1 conducts (and diode D2 is* cut off), charging capacitor *C1 up to the peak rectified voltage (Vm). Diode D1 is ideally* a short during this half-cycle, and the input voltage charges capacitor *C1 to Vm* .

VOLTAGE-MULTIPLIER CIRCUITS

- During the negative half-cycle of the secondary voltage, diode *D1 is cut off and diode D2 conducts charging capacitor* C2.
- Since diode *D2 acts as a short during the negative half-cycle (and diode D1 is open),*we can sum the voltages around the outside loop

- On the next positive half-cycle, diode *D2 is non conducting and capacitor C2 will discharge* through the load. If no load is connected across capacitor *C2, both capacitors* stay charged—*C1 to Vm and C2 to 2Vm*

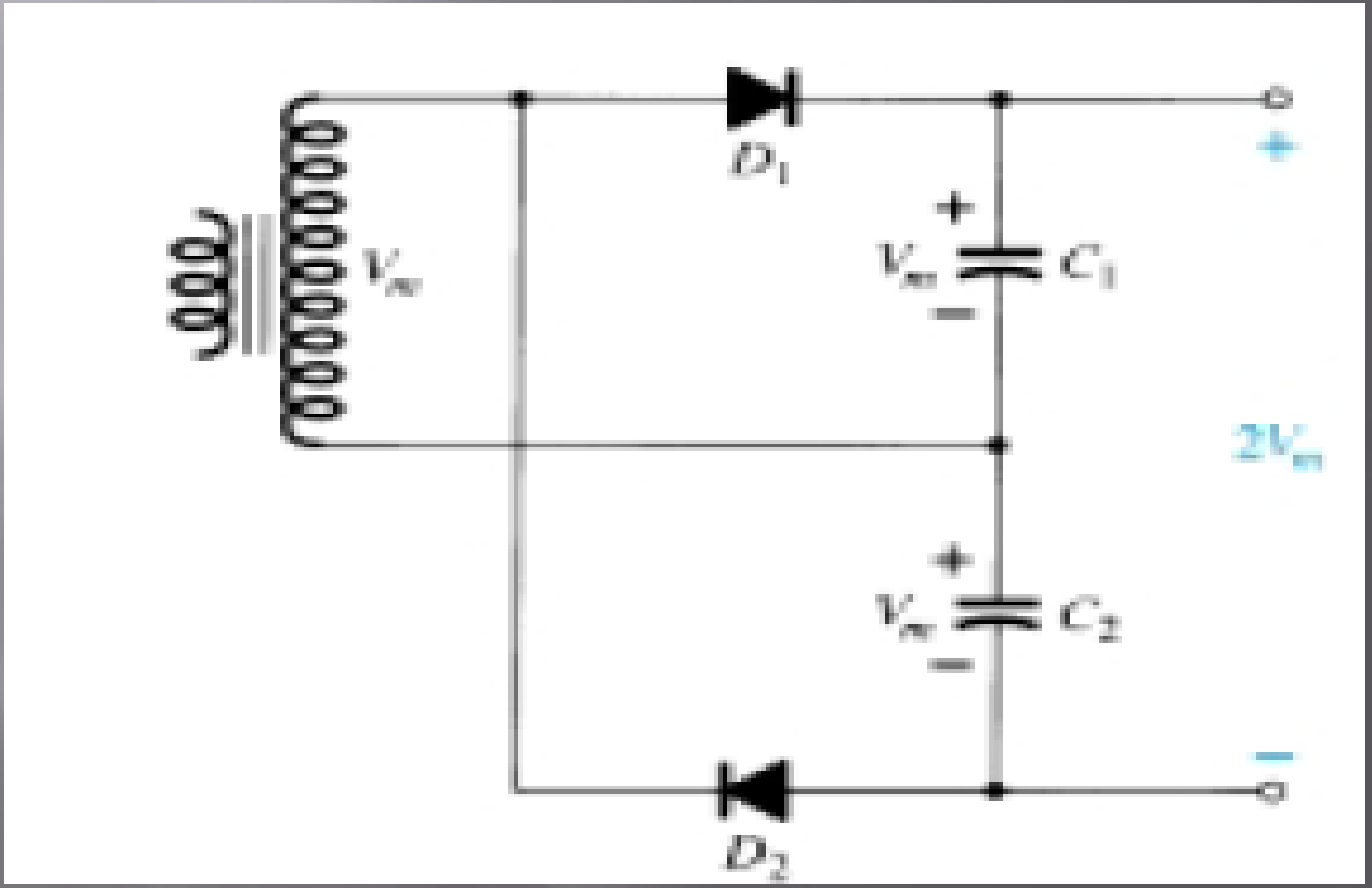
- . *If, as would be expected, there is a load connected* to the output of the voltage doubler, the voltage across capacitor *C2 drops during* the positive half-cycle (at the input) and the capacitor is recharged up to 2*Vm during* the negative half-cycle. The output waveform across capacitor *C2 is that of a* half-wave signal filtered by a capacitor filter. The peak inverse voltage across eachdiode is 2*Vm*.

$$-V_m - V_{C_1} + V_{C_2} = 0$$

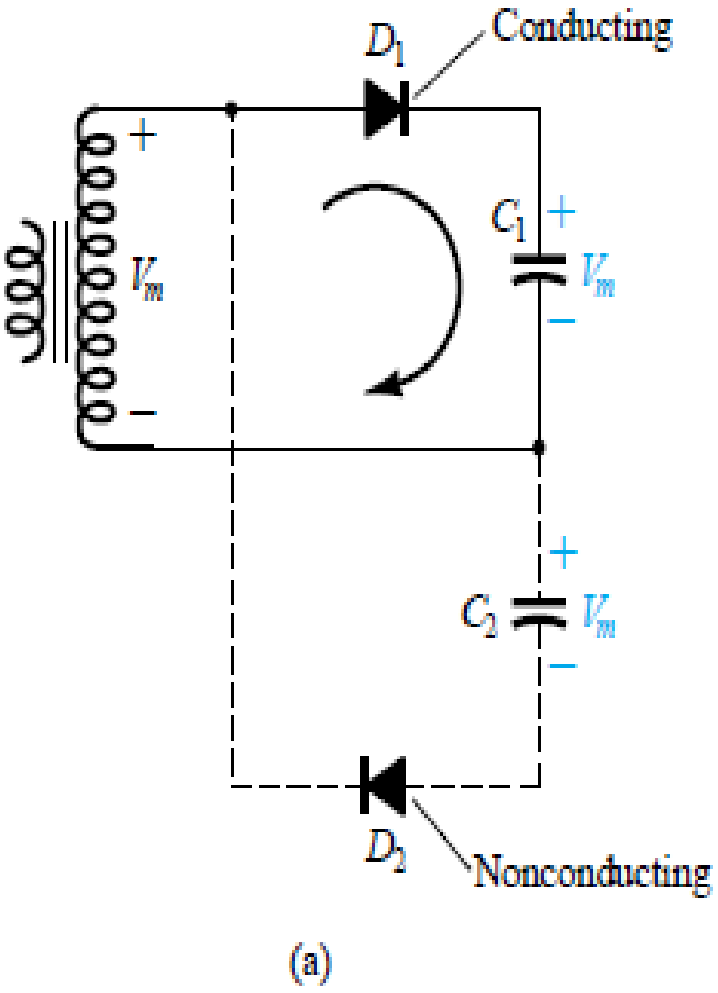
$$-V_m - V_m + V_{C_2} = 0$$

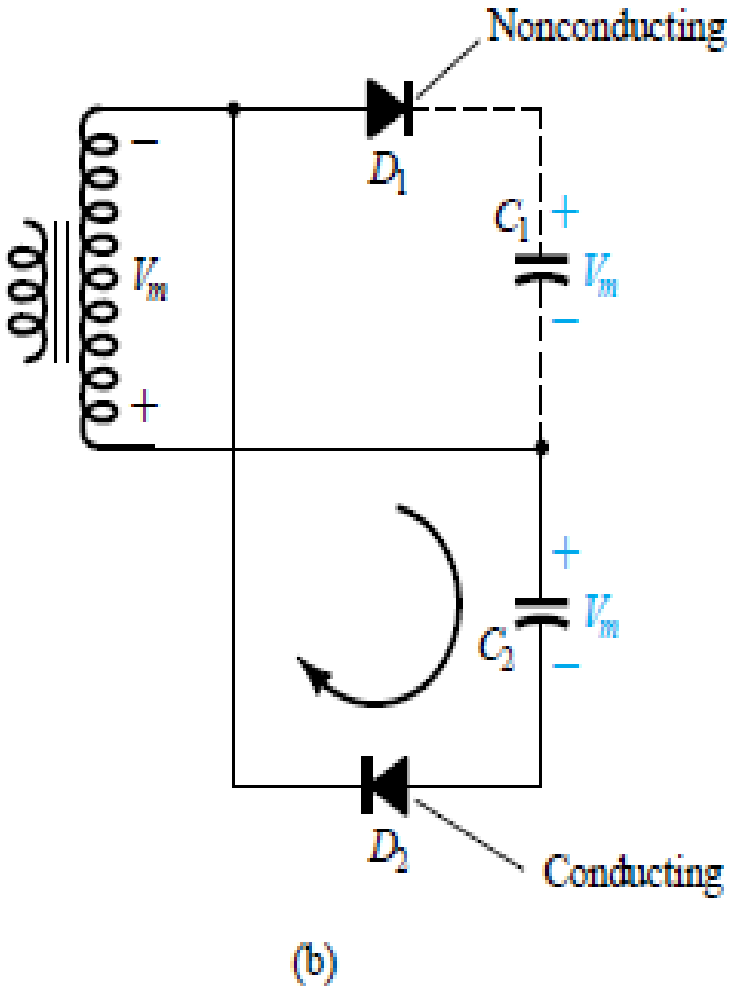
$$V_{C_2} = 2V_m$$

Full wave Doubler



Full wave Doubler





Voltage Tripler and Quadrupler