AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department: Electrical and Electronic Engineering
Program: Bachelor of Science in Computer Science and Engineering
Semester Final Examination: Fall 2021
Year: 2nd **Semester: 1st**
Course Number: EEE 2141
Course Name: Electronic Devices and Circuits
Time: 3 (Three) hours **Full Marks: 70**

There are Eight (8) Questions. Answer any Six (6).

Question 1. [Marks: $11\frac{2}{3}$]

a) Explain with proper derivation that, for a decade change in current, the diode voltage drop changes by $2.3nV_T$. **[5]**

b) Sketch the waveform of v_o for the circuit shown in figure 1(b). **[$6\frac{2}{3}$]**

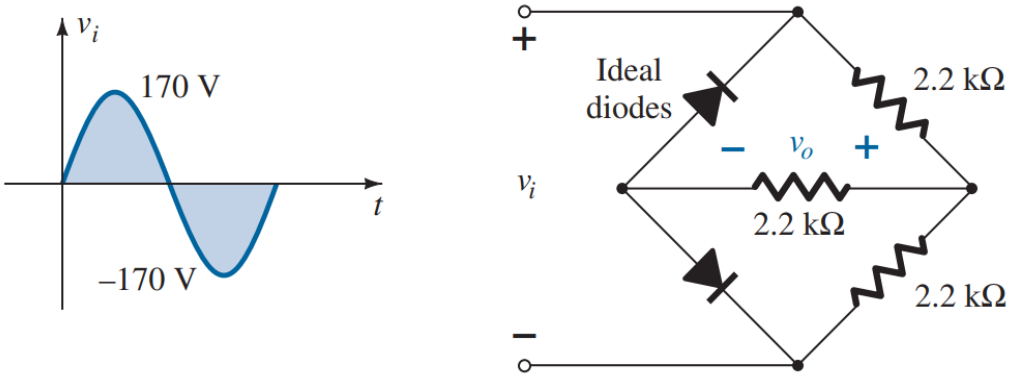

Figure: 1(b)

Question 2. [Marks: $11\frac{2}{3}$]

a) Describe the working principle of a full-wave bridge rectifier, and estimate the maximum possible rectification efficiency. **[2+3]**

b) Find the circuit for the given figure below. **[$6\frac{2}{3}$]**

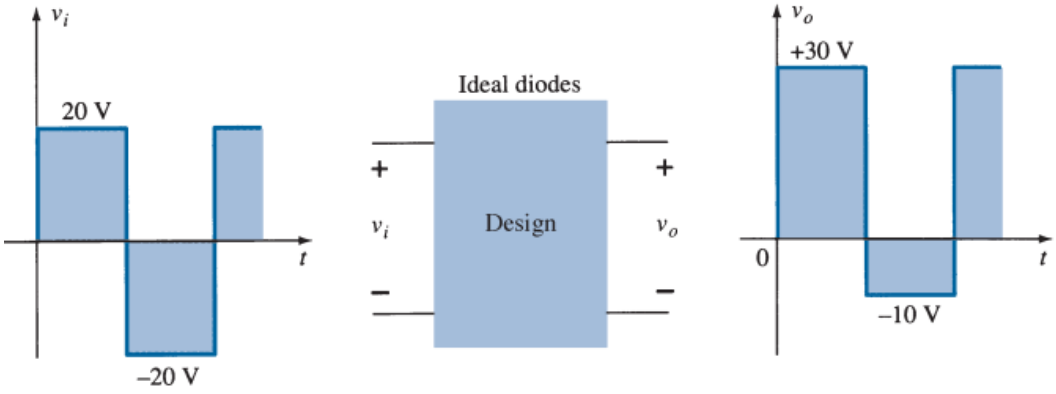

Figure: 2(b)

Question 3. [Marks: $11\frac{2}{3}$]

a) Use operational amplifier with inputs V_1, V_2, V_3, and V_4 such that **[5]**

$$V_0 = 3V_1 - 5V_2 + 9V_3 - 11V_4$$

b) Discuss the working principle of a zero crossing detector using an op-amp and a triangular input voltage source. **[$6\frac{2}{3}$]**

Question 4. [Marks: $11\frac{2}{3}$]

a) Discuss the steps required for IC fabrication. **[5]**

b) Make a logic circuit with CMOS that gives output based on the following equation. Also, show the timing diagram. **[$6\frac{2}{3}$]**

$$Y = ABD + \overline{ACD} + B$$

Question 5. [Marks: $11\frac{2}{3}$]

a) Describe the output characteristics of a common base configuration of BJT. **[5]**

b) Compute the following parameters from the voltage divider bias circuit in Fig. 5 (b). **[$6\frac{2}{3}$]**
i) I_C ii) V_{CE} iii) I_B v) V_E v) V_B
Repeat the solution using **β** = 60 and comment on the changes.

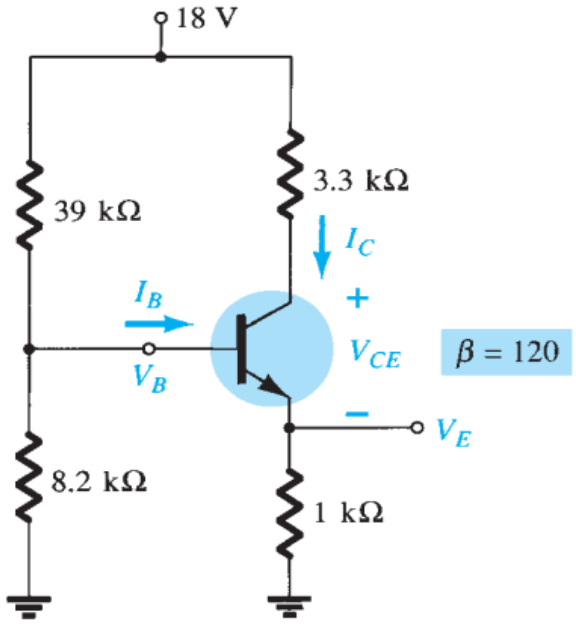

Fig. 5(b)

Question 6. [Marks: $11\frac{2}{3}$]

a) Explain the working principle of a depletion type MOSFET with necessary illustrations. **[5]**

b) Sketch the approximate hybrid model of the following circuit in Fig. 6 (b) and compute the following parameters: **[$6\frac{2}{3}$]**
i) Z_i ii) Z_o iii) A_v iv) A_i

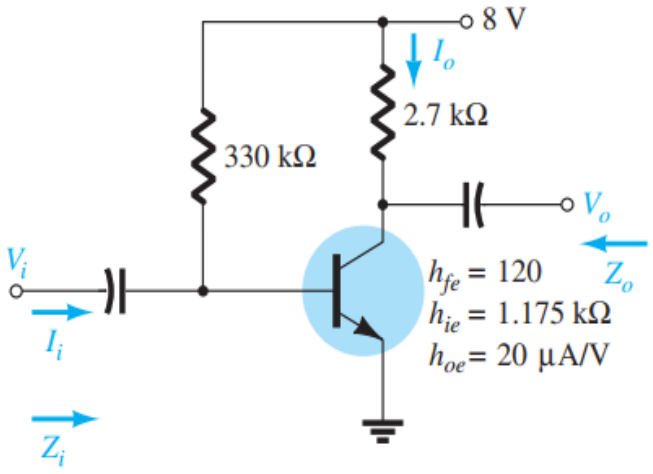

Fig. 6(b)

Question 7. [Marks: $11\frac{2}{3}$]

a) For the summing amplifier circuit in Fig. 7 (a), compute the value of v_2 to make v_o=10 V. Assume the biasing voltage to be ±20V. **[5]**

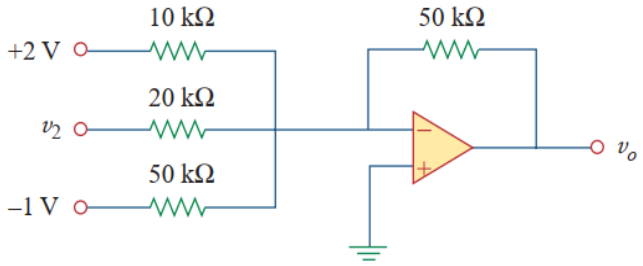

Fig. 7(a)

b) With necessary calculations of different circuit components, illustrate a free running multivibrator using an operational amplifier that will produce a square wave of frequency 1 kHz and duty ratio, D=60%. **[$6\frac{2}{3}$]**

Question 8. [Marks: $11\frac{2}{3}$]

a) With necessary calculations of different circuit components, illustrate a first-order active low pass filter with gain of 10 and a corner frequency of 1kHz. Use 0.01 uF capacitor for your design. **[5]**

b) Explain the operation of an active Band Pass filter using the cascaded configuration of low pass and high pass filter. Also, find the corner frequency and passband gain of that filter. **[$6\frac{2}{3}$]**