Date of Examination: 20/04/2022

AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department: Electrical and Electronic Engineering

Program: Bachelor of Science in Computer Science and Engineering

Semester Final Examination: Spring 2021

Year: 2nd **Semester: 1st**

Course Number: EEE 2141

Course Name: Electronic Devices and Circuits

Time: 3 (Three) hours **Full Marks: 70**

Instruction: Use a separate answer script for each part. Marks allotted are indicated in the **right margin**.

PART A

There are Four (4) Questions. Answer any Three (3).

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

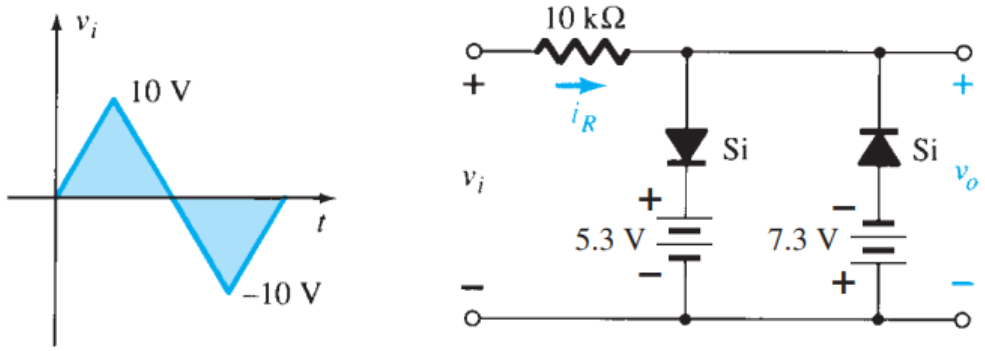

Figure: 1(b)

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

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

b) For the network in figure 2(b), if $R_L = 180\Omega$ **[$6\frac{2}{3}$]**

- Determine V_L, I_L, I_Z, and I_R .
- Calculate again if $R_L = 470\Omega$.
- Determine the value of R_L that will establish maximum power conditions for the Zener diode.
- Determine the minimum value of R_L to ensure that the Zener diode is in the "on" state.

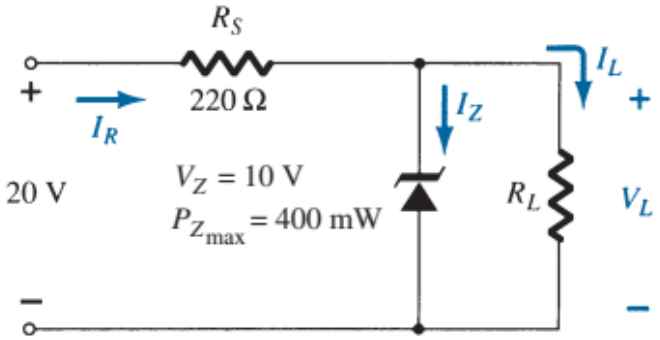

Figure: 2(b)

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]**

$$V_0 = 2V_1 - 9V_2 + 4V_3 - 6V_4$$

b) Build a -4V level 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 different types of turn on method for SCR. Also, give a list of steps required for IC fabrication. **[4+1]**

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

$$Y = \overline{\overline{(A + B)}C + D}$$

PART B

There are Four (4) Questions. Answer any Three (3).

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

a) Explain the reason for stating BJT as a bipolar device. Describe the output characteristics of a common emitter configuration of BJT. **[1+4]**

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

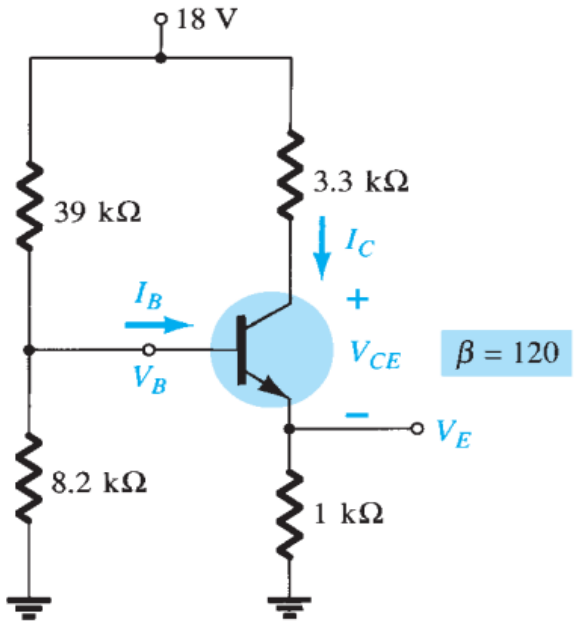

Fig. 5(b)

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

a) Compare between FET and BJT. Explain the working principle of an enhancement type MOSFET with necessary illustrations. **[1+4]**

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

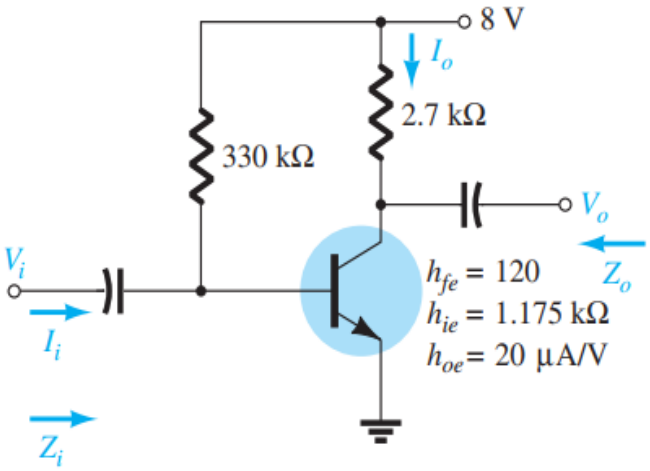

Fig. 6(b)

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

a) For the summing amplifier circuit in Fig. 7 (a), calculate the value of v_2 to make vo=-4 V. **[5]**

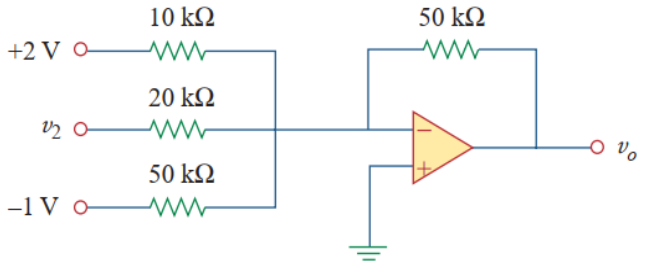

Fig. 7(a)

b) Build a free running multivibrator using an operational amplifier that will produce a square wave of frequency 2 kHz and duty ratio, D=50%. **[$6\frac{2}{3}$]**

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

a) Compare between active and passive filters. Construct a first-order active low pass filter with gain of 4 and a corner frequency of 500 Hz. Use 0.1 uF capacitor for your design. **[1+4]**

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. **[$6\frac{2}{3}$]**