Date of Examination : 27-05-2021

AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department: Electrical and Electronic Engineering
Program: Bachelor of Science in Computer Science & Engineering
Semester Final Examination: Spring 2020
Year: 2nd Semester: 1st
Course Number: EEE 2141
Course Name: Electronic Devices and Circuits

Time: 3 (Three) Hours **Full Marks: 60**

Use a separate answer script for each part

Instructions	
i)	Answer script should be handwritten and should be written on A4 white paper. You must submit the hard copy of this answer script to the Department when the university reopens.
ii)	You must write the following information on the top page of each answer script: **Part A/Part B** **Department:** **Program:** **Course no:** **Course Title:** **Examination:** **Semester (Session):** **Student ID:** **Signature and Date:**
iii)	Write down Student ID, Course number and put your signature on top of every single page of the answer script.
iv)	Write down the page number at the bottom of every page of the answer script.
v)	Upload the scan copy of your answer script in PDF format through provided **google form** at the respective course site (i.e., **google classroom)** using institutional email within the allocated time. Uploading a clear and readable scan copy (uncorrupted) is your responsibility and must cover the full page of your answer script. However, for a clear and readable scan copy of the answer script student should use only one side of a page for answering the questions.
vi)	You must avoid **plagiarism,** maintain **academic integrity, and ethics**. You are not allowed to take any help from another individual and if taken so can result in stern disciplinary actions from the university authority.
vii)	Marks allotted are indicated in the **right margin.**
viii)	Necessary **charts/tables** are attached at the end of the question paper. You may use graph papers where necessary.
ix)	Assume any reasonable data if needed.
x)	Symbols and characters have their usual meaning.
xi)	Before uploading rename the PDF file as **CourseNo_StudentID_PartNo.pdf** e.g., EEE2141_180103001_PartA.pdf EEE2141_180103001_PartB.pdf

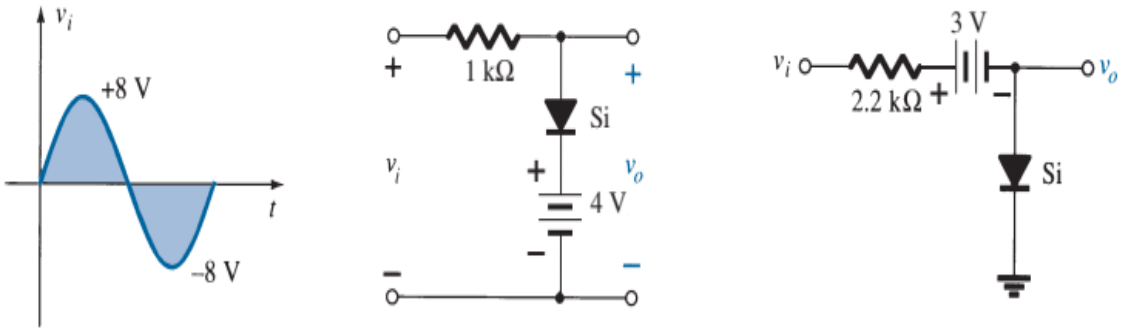
PART A

The answer script (**one single pdf file**) of this part (**Part A)** must be uploaded at a designated location in the provided **google form link** available in the google classroom.

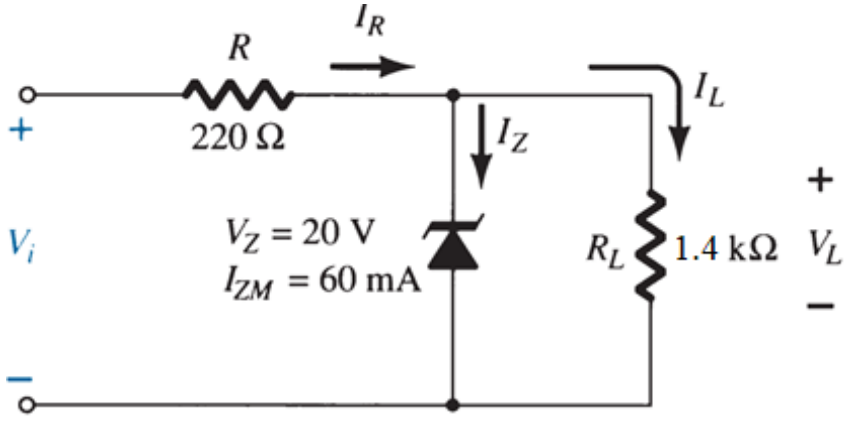
There are 4 (Four) questions in Part-A. Answer any 3 (Three) questions.

Question-4 is compulsory.

Question 1. [Marks: 10]

a)	Describe the forward and reverse bias operation of a diode, and illustrate the I-V characteristics curve indicating different regions.	**[3+2]**
b)	Show v0 for each network of Fig. 1(b) for the input shown.  Fig. 1 (b)	**[3+2]**

Question 2. [Marks: 10]

a)	Describe the working principle of a full-wave bridge rectifier, and estimate the maximum possible rectification efficiency.	**[3+2]**
b)	Compute the range of values of Vi that will maintain the Zener diode in the "on" state.  Fig. 2 (b)	**[5]**

Question 3. [Marks: 10]

a)	Use difference amplifier with inputs V_1, V_2, and V_3 such that $V_0 = -8V_1 + 2V_2 + 5V_3$	**[5]**
b)	Build a 3V level crossing detector using an op-amp and a triangular input voltage source.	**[5]**

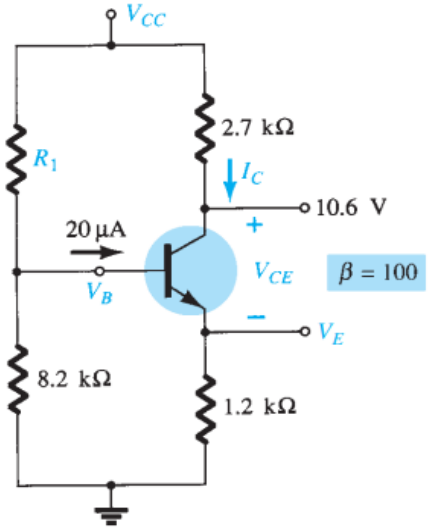
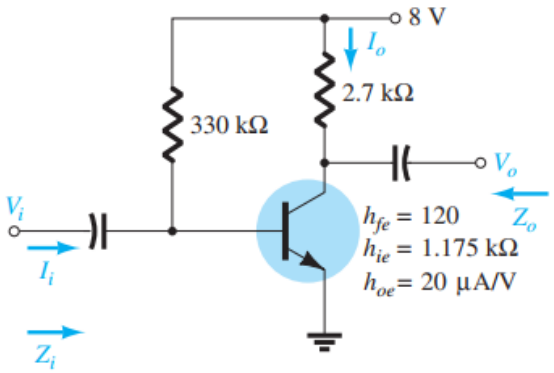
Question 4. [Marks: 10]		
a)	Discuss different regions of SCR's characteristics curve. Also, give a list of steps required for IC fabrication.	**[3+2]**
b)	Build a logic circuit with CMOS that gives output based on the following equation. $$Y = \overline{\overline{AB} + CD}$$	**[5]**

PART B

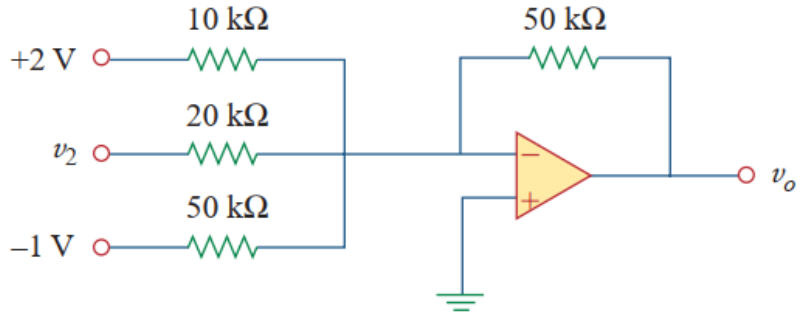
The answer script (**one single pdf file**) of this part (**Part B)** must be uploaded at a designated location in the provided **google form link** available in the google classroom.

There are 4(Four) questions in Part-B. Answer any 3 (Three) questions.

Question-8 is compulsory.

Question 5. [Marks: 10]		
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). i) I_C ii)V_E iii) V_{CC} iv) V_{CE}. v) R_1.  Fig. 5(b)	**[5]**
Question 6. [Marks: 10]		
a)	Compare between FET and BJT. Explain the working principle of a depletion 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: i) Z_i ii) Z_o. iii) A_v. iv) A_i.  Fig. 6(b)	**[1+4]**

Question 7. [Marks: 10]

a)	For the op-amp circuit in Fig. 7 (a), calculate the value of v_2 to make v_o 16.5 V.  Fig. 7(a)	**[5]**
b)	Build a square wave generator using an operational amplifier that has oscillation frequency f=5 kHz and duty ratio D=33%.	**[5]**

Question 8. [Marks: 10]

a)	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 bandwidth of that filter.	**[4+1]**
b)	Construct a first-order active high pass filter with a high-frequency gain of 5 and a corner frequency of 200 Hz. Also, derive the transfer function of that filter.	**[4+1]**