International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Midterm Examination, Spring 2023

Course Code: **EEE 2301** Course Title: **Electronics I**

Time: 1 hour 30 minutes Full Marks: 30

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.

(ii) Course Outcomes (COs) and Bloom's Levels are mentioned in additional Columns.

	Course Outcomes (COs) of the Questions
CO1	Knowledge of basic semiconductor devices such as PN junction and Zener diode, BJT, FET, MOSFET, modeling of diodes, field-effect, and bipolar junction transistors, and different amplifier circuits.
CO2	Problem-solving of different types of electronic circuit consisting of diode, BJT, FET, transistor amplifiers as discrete and integrated devices.
CO3	Design and modelling of BJT, FET, MOSFET, differential and simple amplifier circuits and their small signal, large signal, and frequency response performance.

Bloom's Levels of the Questions						
Letter Symbols	**R**	**Un**	**Ap**	**An**	**E**	**C**
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

1) a) **(i)** Explain in detail with necessary sketch and circuit diagram about forward and reverse bias conditions of a semiconductor diode. CO1 An 5

(ii) What is the difference between electron movement in the conduction band and electron movement in the valance band in a semiconductor material?

1) b) For the following characteristics curve shown in **"Fig. 1"**, answer the following questions. CO2 Ap 5

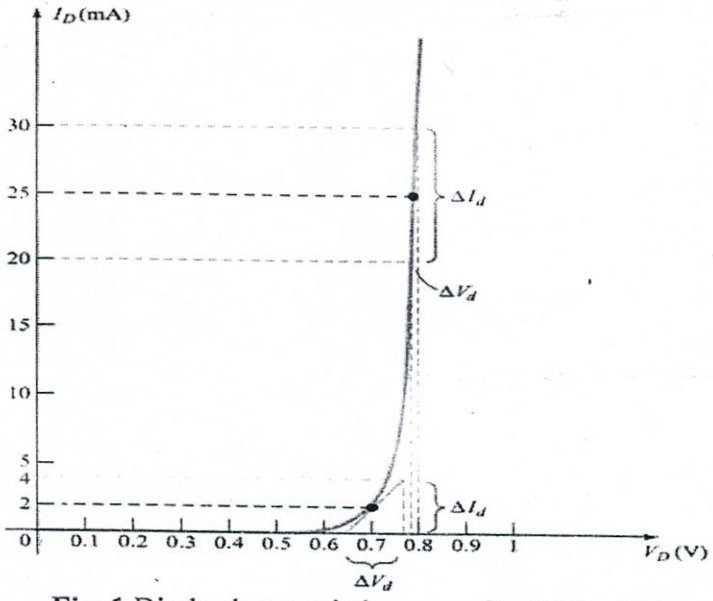

Fig. 1 Diode characteristics curve for Q. No. 1(b)

(i) Determine the ac resistance at $I_D = 2$ mA.
(ii) Determine the ac resistance at $I_D = 25$ mA.
(iii) Compare the results of parts (a) and (b) to the dc resistances at each current level.

2)	a)	**(i)** Draw a full-wave rectifier circuit. Explain how a smooth DC output can be obtained from pulsating DC. Also, show that the efficiency of a full-wave rectifier is 81%. **(ii)** Discuss how the Zener diode can act as a voltage regulator.	CO1 CO1	An Ap An	3+2 2
2)	b)	Determine Vo for the network shown in **"Fig. 2"**. Also, sketch the output characteristics.	CO2	E	3

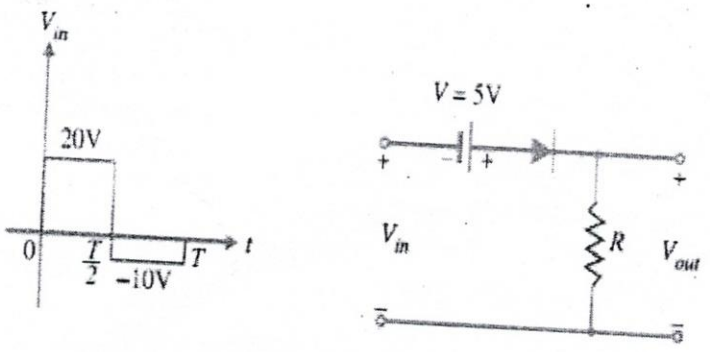

Fig. 2 Clipper circuit for Question No. 2(b)

3)	a)	Design a base resistor bias circuit for a CE (Common-Emitter) amplifier such that operating point is $V_{CE} = 8$ V and $I_C = 2$ mA. Consider that the circuit is supplied with a fixed 15 V d.c. supply and a silicon transistor with $\beta = 100$. Take base-emitter voltage $V_{BE} = 0.6$ V. Also, calculate the value of load resistance that would be employed.	CO2	C	5
3)	b)	Sketch the transfer characteristics of the CE amplifier. Calculate the emitter current in the voltage divider circuit shown in **Fig. 3.** Also, find the value of V_{CE} and collector potential, V_C.	CO2	E	5

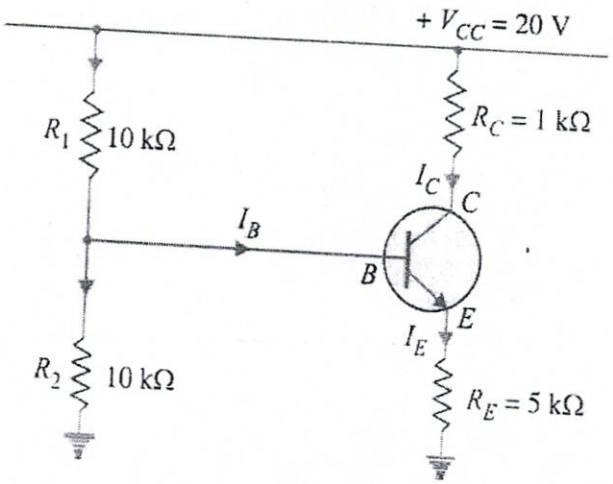

Fig. 3 Voltage divider circuit for Question No. 3(b)

OR

3) a) Show that $\alpha=\beta/(\beta+1)$, where symbols represent their usual meaning. Also, determine the currents I_E and I_B, and the voltages V_{CE} and V_{CB} for the common-base configuration of **"Fig. 4"**. CO2 E 5

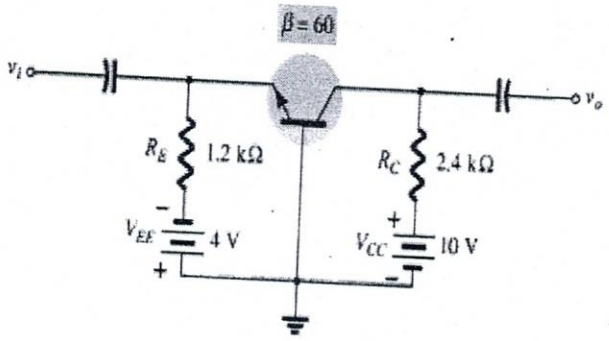

Fig. 4 CB configuration circuit

3) b) Determine the following for the fixed-bias configuration of **"Fig. 5"**. **(i)** I_{BQ} and I_{CQ} **(ii)** V_{CEQ} **(iii)** V_B and V_C **(iv)** V_{BC}. CO2 E 5

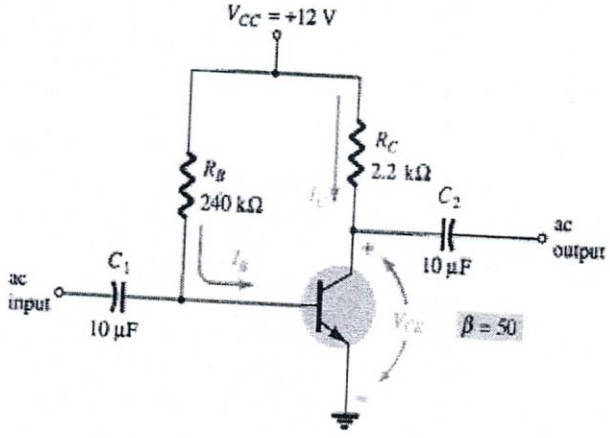

Fig. 5 Fixed-bias configuration