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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN ELECTRICAL
AND
COMMUNICATION ENGINEERING

COURSE CODE: ECE 203

COURSE TITLE: BASIC ELECTRONICS

DATE: 15TH DECEMBER, 2022 TIME: 8: 00 AM – 10:00 AM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

Question One

a. Deduce an expression for orbital frequency of revolving electrons.

b. Draw and briefly describe **THREE** transistor configurations. Indicate the polarities of the terminals.

c. Explain using basic illustrations the electrical conduction properties of:
   i. Insulators
   ii. Semiconductor
   iii. Conductors

d. Define the following terms:
   i. Electric field
   ii. Resistivity
   iii. Mobility
   iv. Dopant

e. A varactor diode has capacitance of 5pF when the reverse bias voltage applied across it is 6V. Calculate the diode capacitance if the bias voltage is increased to 8V.

Question Two

a. Explain how you would obtain n-type and p-type semiconductor materials. Use suitable illustrations.

b. Draw suitable transistor output characteristics and
   i. Show the quiescent operating point
   ii. State the functions of a load line.

Question Three

a. Using the suitable circuit diagram and waveforms, explain the principle of operation of a center-tap rectifier.

b.

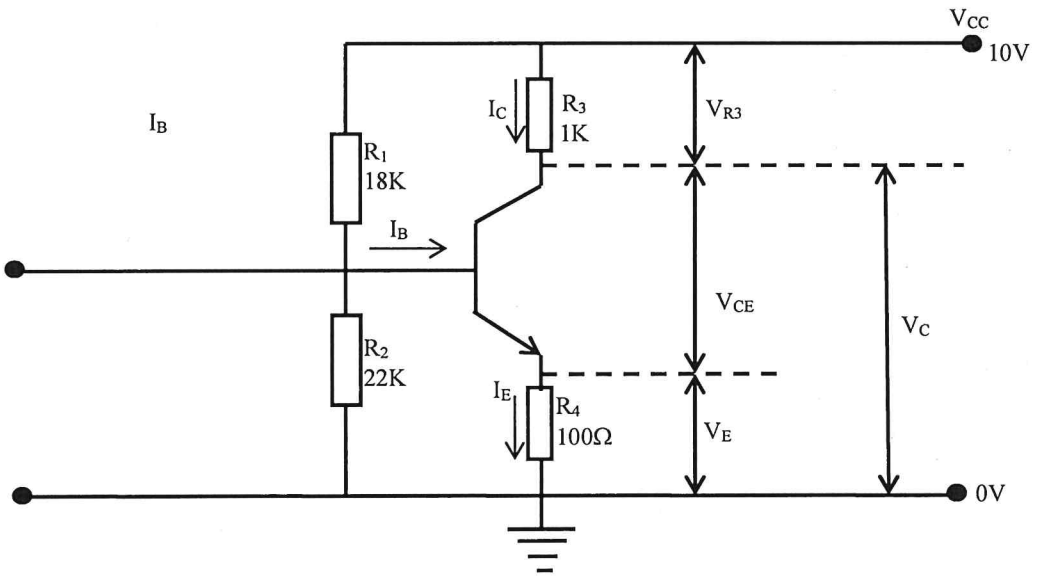

Figure 1

The circuit of figure 1 has components given as $V_E = V_B - 0.7$. Design the amplifier by calculating the following biasing values:

i)	V_B	iii)	I_E	v)	V_{CE}
ii)	V_E	iv)	V_{R3}	vi)	V_C

Question Four

a. Distinguish between intrinsic and extrinsic semiconductor materials.

b. Derive that the efficiency of a half-wave rectifier as:

$$\gamma = \frac{\mathbf{I_{dc}}}{\mathbf{I_{max}}} \times \frac{R_L}{R_L + r_f}$$

Question Five

a.

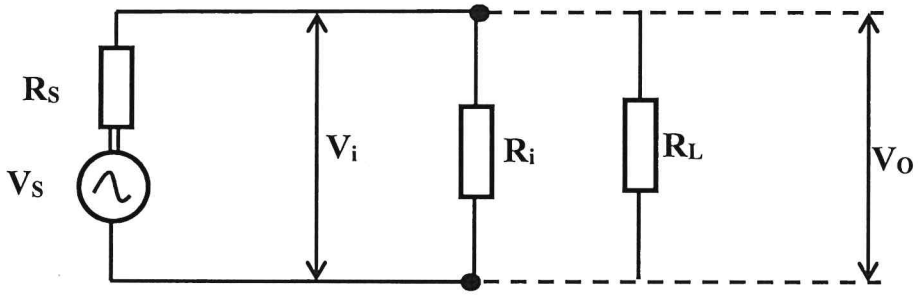

Figure 2

Based on the equivalent circuit of figure 2, derive that the power gain A_P is a product of voltage gain A_V and current gain A_i:

$$\mathbf{A_p = A_V A_i}$$

b. A diode forward biased has a resistance of 50 ohms, supplies power to a load resistance of 1200 ohms from 20 V_{rms} source.

Calculate:

i. The dc load current.

ii. The ac load current.

iii. The dc output power.