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**UNIVERSITY EXAMINATIONS
2021/2023 2 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS**

**FOR THE DEGREE
OF
BACHELOR OF EDUCATION SCIENCE.**

COURSE CODE: SPH 327

COURSE TITLE: INTRODUCTION TO ELECTRONICS

DATE: 25/11/2022

TIME: 8:00AM - 10:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

**Answer question ONE and any TWO of the remaining.
Symbols used bear the usual meaning.**

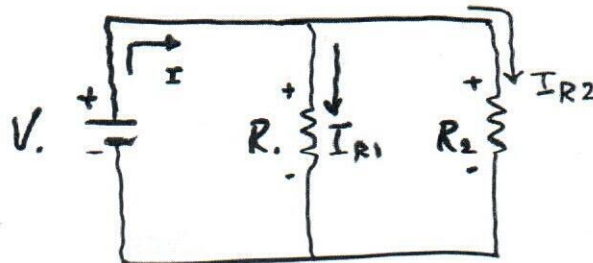
Useful constants $V_{BE} = 0.7V$

QUESTION ONE (20 MARKS)

- a) Describe the operation of PN junction diode under forward and reverse bias. (4 marks)
- b) Describe experiments to determine transistor characteristics (2marks)
- c) Explain applications of diodes and transistors (2marks)
- d) Using Thevenin's Theorem, determine V_o across parts A and B. (6 marks)
- g) Define energy bands, electrons and holes as used in semiconductor physics (3marks)
- g) Derive the relationship between α and β giving their respective meaning. (2 marks)
- h) Draw a n-p-n transistor connected in Common emitter configuration showing clearly all the current directions. (3 marks)
- i) Differentiate between intrinsic and extrinsic semiconductors (2 mark)
- j) Explain clearly with suitable waveforms, the working of a half wave rectifier. (6 marks).

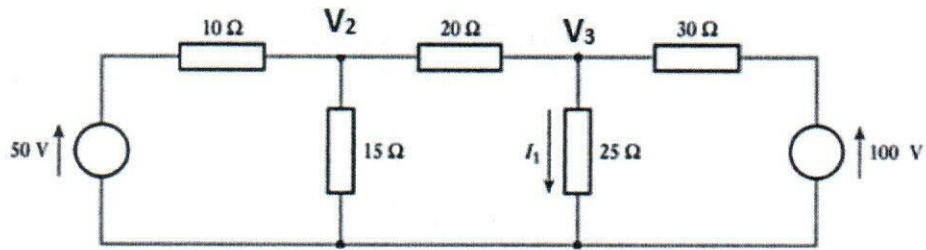
QUESTION TWO (20 MARKS)

- a) Consider the circuit shown, where $R_1 = 20\Omega$, $R_2 = 40\Omega$, $V_1 = 20V$. Calculate (a) The current through R_1 . (b) The current through R_2 . (c) The current leaving the voltage source. (6 marks)



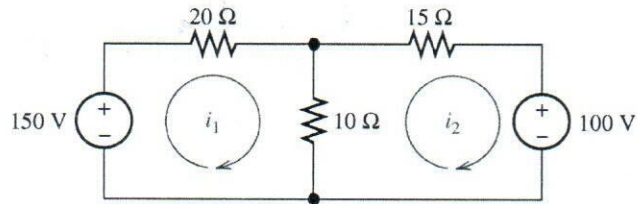
- b) Briefly explain with a suitable diagram how D.C load line can be determined from a BJT characteristic curve. (7 marks)

- c) c) Use Nodal analysis to determine the current I_1 in the following circuit. (7 marks)



QUESTION THREE (20 MARKS)

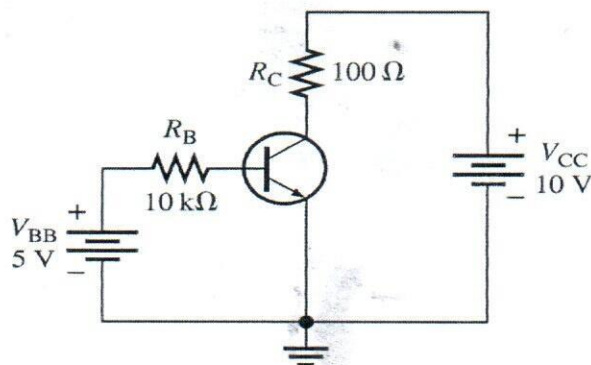
- a) Use Mesh Current Analysis to find I_1 and I_2 in the following circuit (7 marks)



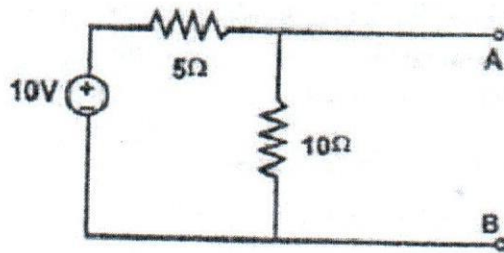
- b) Describe how to obtain the input and output characteristics of common emitter npn transistor (Use a clear circuit diagram to illustrate your answer). (5 marks)
- c) For a transistor connected in common emitter configuration, sketch the typical output characteristics relating collector current and the collector-emitter voltage, for various values of base current. Explain the shape of the characteristics. (8 marks)

QUESTION FOUR (20 MARKS)

- a) State and explain the function and application of diode clipper using a suitable diagram. (6 marks)
- b) Determine I_B , I_C , I_E , V_{CE} and V_{CB} in the circuit below. The transistor has a $\beta = 150$. (8 marks)

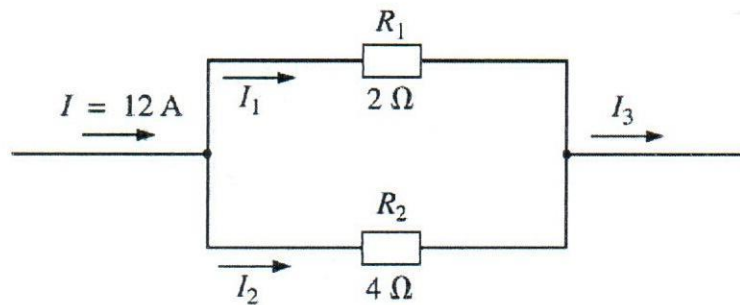


- (c) Use Norton's theorem to find short AB and $R_N = R_{TH}$. (6 marks)



QUESTION FIVE (30 MARKS)

- a) With examples, distinguish between active and passive devices (2 marks)
- b) Define the following terms (i) branch (ii) node and (iii) loop (3 marks)
- d) State Kirchoff's laws. (2marks)
- c) Use current divider rule to determine I_1 and I_2 in the following circuit. (2 marks)



- d) Define doping? (1 marks)
- e) Use band gap theory to explain the difference between conductors, insulators and semiconductors. (6 marks)
- f) Explain the working principle of Zener diode. Draw its characteristics. (4 marks)