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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
KCS 2203 – ANALOGUE ELECTRONICS

Date: 04TH December 2024
Time: 2:30PM – 4:30PM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Define and briefly explain the following types of semiconductors.
   i) P-type semiconductor (3 Marks)
   ii) N-Type semiconductor. (3 Marks)

b) There are two types of impurities, trivalent and pentavalent impurity which can be added to a pure semiconductor to make it to increase it's conductivity. Explain why trivalent impurity is referred to as acceptor impurity and pentavalent impurity referred to as a donor impurity. (4 Marks)

c) Zener diode is one of the major pn junction diode which can be used in voltage regulation in AC and DC circuits. Explain what we mean by zener breakdown and it's importance in voltage regulation. (4 Marks)

d) Explain plain the three operating regions of a Metal oxide semiconductor field effect transistor(MOSFET) . (6 Marks)

e) Define transistor biasing, with the help of a diagram explain the difference between forward and reverse biasing. (6 Marks)

f) Using Ohm's law, explain the relationship between voltage, current and resistance. (4 Marks)

QUESTION TWO (20 MARKS)

a) A tunnel diode is a heavily doped p-n junction diode that shows negative resistance. Explain how a tunnel diode works when;
   i) The diode not biased. (3 Marks)
   ii) When a small voltage is applied across the diode (3 Marks)
   iii) When the voltage applied is largely increased. (3 Marks)

b) Give any three application of tunnel diode. (3 Marks)

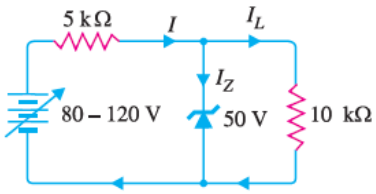
c) Extrinsic semiconductor is categorized into p-type and n-type types of semiconductor. Explain any four major differences between the p-type and n-type semiconductors. (8 Marks)

QUESTIONS THREE (20 MARKS)

a) Zener diode is one of the major pn junction diode which can be used in voltage regulation in AC and DC circuits. Explain the following Zener diode specifications
   i) Zener/Breakdown Voltage. (2 Marks)
   ii) Current I_z(Max) & Current I_z(Min). (2 Marks)

iii) Power Rating (P_z). (2 Marks)
iv) Zener Resistance. (2 Marks)

b) The figure below shows a zener diode voltage regulator circuit.



i) Calculate the maximum value of the zener diode current(I_z) (4 Marks)
ii) Calculate the Minimum value of the zener diode current(I_z) (4 Marks)

c) Given that a transistor has a β_{DC} of 250 and a base current, I_B, of 20 μ A. Calculate the collector current, I_c. (4 Marks)

QUESTION FOUR (20 MARKS)

a) BJT is a three terminal electronic device and it has three possible ways of connecting it to an electronic circuit. Using suitable diagrams explain the following bipolar junction transistor configurations.
i) Common Base Configuration. (4 Marks)
ii) Common Emitter Configuration. (4 Marks)
iii) Common Collector Configuration. (4 Marks)

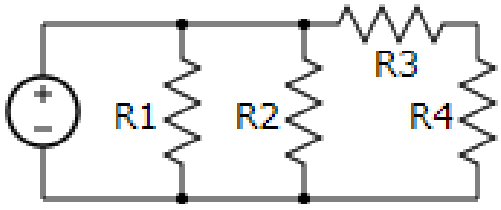
b) Transistor amplifiers can be classified according to different consideration, explain transistor amplifier classification based on the following parameters.
i) Number of stages. (2 Marks)
ii) Coupling method. (6 Marks)

QUESTION FIVE (20 MARKS)

a) An intrinsic semiconductor has no or very little electrical conductivity at absolute zero temperature. Explain the effects of increasing the temperature of an intrinsic semiconductor material. (6 Marks)

b) During design of transistor circuits, it is important to transistor well biased. State what happens in case a transistor is not properly biased in a circuit? (4 Marks)

c) The figure below shows a circuit with four resistors. R_1 and R_2 are in parallel while R_2 and R_4 are in series. There resistances are 20 Ω, 20 Ω, 30 Ω and 10 Ω respectively.



If the resistors are connected in a voltage source of 24V. Calculate.
i) Total or equivalent Resistance. (6 Marks)
ii) Current across the circuit. (4 Marks)