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UNIVERSITY EXAMINATIONS 2024/2025

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

EET 3210: ELECTRONICS

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.
: Start each question on a fresh page

QUESTION ONE (30 MARKS)

a) Explain the concept of energy bands in solids. (2 Marks)

b) Explain the working of a P-N junction diode under forward and reverse bias. (2 Marks)

c) Explain the characteristics of the Binary Number System. (2 Marks)

d) Describe the different configurations of a Bipolar Junction Transistor (BJT)? (3 Marks)

e) Convert the binary number 10101_2 to its decimal equivalent? Show the steps. (4 Marks)

f) Explain the process for converting a decimal number to binary? Use the number 2910 as an example. (4 Marks)

g) Explain the difference between a half-adder and a full-adder? (4 Marks)

h) Describe the difference between an NPN and PNP transistor. (4 Marks)

i) Describe the differences between intrinsic and extrinsic semiconductors. (3 Marks)

j) Explain the steps involved in converting a binary number to an octal number. Provide an example using 10101_2. (2 Marks)

QUESTION TWO (15 MARKS)

a) Define what is a transistor, and its main parts. (5 Marks)

b) Explain what a TRIAC is by

i. Explaining the construction and operation (7 Marks)

ii. Giving **THREE** of its application of (3 Marks)

QUESTION THREE (15 MARKS)

a) State DeMorgan's Theorem? (3 Marks)

b) Describe how a Boolean expression simplified using a Karnaugh Map (K-map)? (2 Marks)

c) Explain the forbidden energy gap, and how does it vary among conductors, semiconductors, and insulators. (10 Marks)

QUESTION FOUR (15 MARKS)

a) Explain the Hall Effect, and how is it used in electronic devices. (5 Marks)

b) Derive collector current for a common collector configuration of a transistor. **(**10 Marks)

QUESTION FIVE (15 MARKS)

a) Explain the operation of a Zener diode under reverse bias, and its applications. (4 Marks)

b) Define and differentiate between the Octal and Hexadecimal number systems. (3 Marks)

c) Convert the octal number 12570_8 to its decimal equivalent. (3 Marks)

d) Describe the basic logic gates and draw their truth tables. (5 Marks)