TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MATHEMATICS & COMPUTER SCIENCE

APS 4112: PHYSICS ELECTRONICS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: JULY 2014
TIME ALLOWED: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FOUR** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

Question One (Compulsory)

a) Define the following terms:
    (i) Donor and acceptor impurities   **(2 marks)**
    (ii) Rectification   **(1 mark)**
    (iii) Peak inverse voltage   **(1 mark)**
    (iv) Pn junction   **(1 mark)**
    (v) Zener diode   **(1 mark)**

b) Distinguish between conductors, semiconductors and insulators.   **(3 marks)**

c) Find the current flowing through the resistors and the corresponding voltage drops in the resistors in the figure below (assume the diodes are ideal)   **(3 marks)**

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d) A half wave crystal diode rectifier is transformer fed from a 240V line. Calculate:
    (i) Turn ratio **(4 marks)**
    (ii) Diode Piv rating if the circuit provides an output of 24Vdc. **(2 marks)**
e) Explain THREE types of filter circuits. **(3 marks)**

f) Explain how a Zener diode acts as a voltage regulator. **(3 marks)**

g) (i) In a common base connection, the emitter current is 2mA. If the emitter circuit is open, the
collector current is 40 μA. Find the term collector current given that $\alpha = 0.92$ **(3 marks)**

    (ii) Draw circuit diagrams to distinguish between npn and pnp transistors. **(2 marks)**

Question Two

a) Explain the working of a npn and pnp transistors. **(5 marks)**

b) Find the value of B if (i) $\alpha = 0.9$ and (ii) 0.94 and (iii) 0.97. **(3 marks)**

c) Explain the operation of a transistor as:
    (i) An amplifier **(3 marks)**
    (ii) A switch **(3 marks)**

d) The base current in a transistor is 0.02mA and emitter current is 1.0mA. Calculate the values of α and β.
     (4 marks)

e) Define the following:
    (i) Tished Amplifiers **(2 marks)**

Question Three

a) Explain transistor biasing by:
    (i) Base resistor method **(3 marks)**
    (ii) Biasing with feedback resistor **(3 marks)**

b) The figure below shows a Silicon transistor with $\beta = 120$ biased by base resistor method. Draw the d.c. load line and determine the operating point. **(7 marks)**

c) The figure below shows a two stage transistor amplifier biased by base resistor method. What are collector-emitter voltages? Assume $\beta = 110$ and VBE = 0.77V **(7 marks)**

Question Four

a) Define the following terms in relation to transistor amplifier circuit. **(8 marks)**
   (i) Input resistance

(ii) Output resistance
(iii) d.c. load
(iv) a.c load

b) In the figure below the transistor has $\beta = 80$. Find the voltage gain if input resistance Rin = 0.4 $K\Omega$

(6 marks)

c) State THREE features incorporated into voltage amplifier and power amplifier so as to achieve high amplification. **(6 marks)**

Question Five

a) Define the following terms:
　　(i) Frequency response **(1 mark)**
　　(ii) Band width **(1 mark)**
　　(iii) Decibel gain **(1 mark)**

b) Express the following gains as a number:
　　(i) Power gain of 40db **(2 marks)**
　　(ii) Power gain of 53db **(2 marks)**

c) A three stage amplifier has the first stage voltage gain of 200, second stage voltage gain of 300 and third stage of 500. Find the total voltage gain in db. **(7 marks)**

d) A class A power amplifier has zero signal collector current of 40mA. If the collector supply voltage is 4v find:
　　(i) Maximum a.c. power output **(2 marks)**
　　(ii) Power rating of transistor **(2 marks)**

(iii)   Maximum collector efficiency   **(2 marks)**