KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER
SPECIAL/SUPP EXAMINATIONS

FOR THE DEGREE OF BSC RENEWABLE ENERGY AND BIOFUELS

COURSE CODE: **REN 213**

COURSE TITLE: **BASIC ELECTRICAL TECHNOLOGY**

DURATION: 2 HOURS

DATE: TIME: 01/02/21 11:00 - 1:00 PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **4** printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

Question One.

a) Define the following terms
   i) Valence electrons
   ii) Positive charge fixed ion
   iii) Doping

(3 marks)

a) i) Define the term Karnaugh maps as used in Boolean algebra
(1 marks)

ii) Simplify the Boolean logic expression

$A = x.y + \bar{y}.z + x.z + x.y.z$ (4 marks)

b) With a well labeled diagram and transfer characteristics describe the construction an n-channel JFET

(4 marks)

c) i) What value of series resistor is required to limit the current through a LED to20 mA with a forward voltage drop of 1.6 V when connected to a 10V supply?

(3 marks)

ii) With aid of necessary diagrams explain the operation of a Varactor diode

(4 marks)

d) State FOUR conditions to be met by transistor so that it acts as faithful amplifier
(4 marks)

e) Describe the operation of common base amplifier transistor configuration

(4 marks)

f) Define the following terms as applied in filter circuits
   i) Low pass filter
   ii) High pass filter
   iii) Band pass filter
(3 marks)

Question Two

a) Define the following terms
   i) Combinational logic circuit
   ii) Sequential logic circuit

(2 marks)

b) Draw a well labeled diagram and explain using clock pulses the working principle of S-R flip flop

(6 marks)

c) Draw the circuit diagram of twisted ring counter and explain its operation

(4 marks)

d) Simplify the following expression

$Y = \left(a.b.\left(c + \overline{b.d}\right) + \overline{a.b}\right)c.d$

(4 marks)

e) With aid of circuit diagram and truth table describe the operation of **full adder**
(4 marks)

Question Three.

a) Define the following terms as applied in transistor amplifiers
   i) Emitter efficiency (γ)
   ii) Transport factor (β^*)
   iii) Large signal current gain (α) (3 marks)

b) With aid ofa suitable diagram describe the construction of an n-type semiconductor (3 marks)

c) Show that the stability factor of a transistor is given by the expression

$$S = \frac{1+\beta}{1-\beta\frac{dI_B}{dI_C}}$$ (4 marks)

d) With aid of a circuit diagram describe the principle of operation of emitter feedback bias mode of transistor biasing (4 marks)

e) The fig 1 shows silicon BJT transistor voltage divider biasing circuit, if R_1=2kΩ,R_2=4kΩ,R_E=1kΩ,V_{CC}=12V and β=50. Calculate the following parameters
   i) Base current (I_B)
   ii) Collector current (I_C)
   (6 marks)

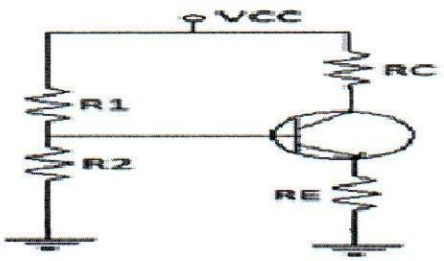

Fig 1

Question Four.

a) i) State THREE advantages of FETs over BJT transistors (3 marks)

b) Explain the following terms as applied in FETs
   i) Ohmic region
   ii) Cut off region
   iii) Saturation region
   iv) Break down region (4 marks)

c) With a well labeled diagram and transcoductance curve describe the construction and operation of n-channel MOSFET in the depletion mode

(6 marks)

d) State THREE advantages of using LEDs over incandescent lamps

(3 marks)

e) With suitable diagrams explain the principle of operation of tunnel diode

(4 marks)

Question Five.

a) The input and output voltages of a filter network are 16 mV and 8 mV respectively. Calculate the decibel level of the output voltage

.(3 marks)

b) i) With aid of circuit diagram and waveforms describe the operation of a low pass filter

(4 marks)

c) A Low Pass Filter circuit consisting of a resistor of 4k7Ω in series with a capacitor of 47nF is connected across a 10V sinusoidal supply. Calculate the output voltage (VOUT) at a frequency of 100Hz

(3 marks)

d) Design a high-pass RL filter that has a cutoff frequency of 4 kHz when R = 3 kΩ. It is connected to a $10\angle 0^0$ V variable frequency supply. Calculate theoutput voltage V0 and its decibeldecrease at

(i) f = 0
(ii) f = fc
(iii) f=8 kHz (6 marks)

e) State FOUR functions of a microprocessor (4 marks)