



## **SOUTH EASTERN KENYA UNIVERSITY** **UNIVERSITY EXAMINATIONS 2016/2017**

### **FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (PHYSICS) AND BACHELOR OF EDUCATION (SCIENCE)**

#### **SPH 307: INTRODUCTORY ELECTRONICS**

**DATE: 15<sup>TH</sup> DECEMBER, 2016**

**TIME: 1.30-3.30 P.M**

#### **INSTRUCTIONS TO THE CANDIDATES**

- (a) This paper consists of five questions  
(b) Answer question **ONE** and **ANY OTHER TWO** questions

#### **Question One (30 marks)**

- a) Using a simple sketch explain
- i) How a depletion layer of a p-n junction is formed **(2 marks)**
  - ii) Forward characteristics of the junction **(3 marks)**
- b) Calculate the barrier potential at the following temperatures for silicon junction if its value at 25°C is 0.7V
- i) 100°C **(2 marks)**
  - ii) 25°C **(2 marks)**
- c) Given an heavily doped p-n junction;
- i) Explain the concept of tunneling as used in quantum Physics **(2 marks)**

- ii) Using the band theory explain how tunneling is achieved in a tunnel diode (2 marks)
- iii) Describe the tunnel diode VI characteristics (3 marks)
- d) Given a PNP transistor
- i) Sketch a PNP transistor common collector configuration (2 marks)
- ii) The following current readings are obtained I transistor circuits shown the figure  $I_E = 2mA$  and  $I_B = 20\mu A$  compute the values of  $\alpha$  and  $I_C$  (2 marks)
- iii) Given a common emitter transistor configurations show that  $1 - \alpha = \frac{1}{1+\beta}$  (3 marks)
- e) Explain the following terminologies used in field effect transistors (FET)
- i) Source (1 mark)
- ii) Drain (1 mark)
- iii) Channel (1 mark)
- f) For a single stage CB amplifier shown find
- i) Stage input resistance (1 mark)
- ii) Stage output resistance (1 mark)
- iii) Current gain (1 mark)
- iv) Voltage gain of the stage (1 mark)

### **Question Two (20 marks)**

- a) Given a diode
- i) Explain three main applications of a diode (6 marks)
- ii) How is a seed crystal grown? Explain any three diode fabrication techniques (4 marks)
- b) A silicon diode has a forward drop of  $1.2V$  for a forward dc current of  $100mA$ . It has a reverse current of  $1\mu A$  for a reverse voltage of  $10V$ . Calculate;
- i) Bulk resistance and reverse resistance of the diode (4 marks)
- ii) Ac resistance at forward dc current of  $2.5mA$  and  $25mA$  (6 marks)

### **Question Three (20 marks)**

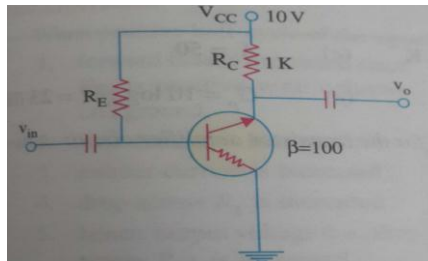
- a) Given a PNP transistor and the necessary circuit components
- i) Sketch a circuit that can be used as a single stage CE amplifier (4 marks)
- ii) Explain the circuit operation in 3.a)(i) above (5 marks)

iii) Write the characteristics of a CE amplifier (4 marks)

b) For the transistor amplifier shown below

i) Explain the meaning of an amplifier described as 'small-signal, class A, CE, voltage amplifier' (2 marks)

ii) Calculate the voltage gain without load resistor (5 marks)



**Question Four (20 marks)**

a) Using a sketch explain the basic construction of

i) P-channel JFET. (5 marks)

ii) A DEMOSFET (5 marks)

b) Given a JFET transistor

iii) Sketch its drain characteristics with  $V_{GS} = 0$  (4 marks)

iv) Using a simple sketch in 4.a)(i) above, explain its drain characteristics with  $V_{GS} = 0$  (6 marks)

**Question Five (20 marks)**

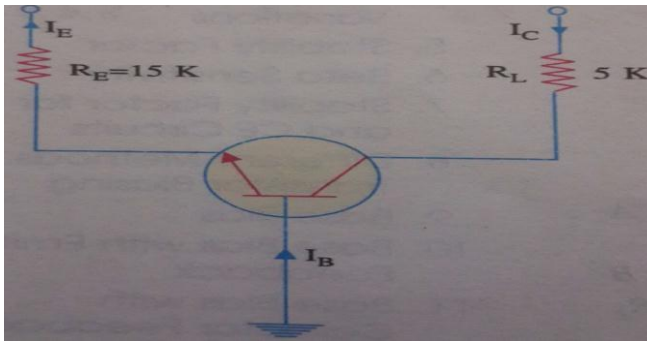
a) Given a transistor in operation explain the following terms

i) The active region (4 marks)

ii) Quiescent point (5 marks)

iii) Write the basic equation governing the quiescent point (3 marks)

b) For the circuit shown and neglecting  $V_{BE}$



i) Draw its dc load line

(3 marks)

ii) Locate its quiescent or dc load line

(5 marks)