EAST AFRICAN SCHOOL OF AVIATION EXAMINATION

END TERM I EXAMS

DIPLOMA IN AERONAUTICAL ENGINEERING

Electronics and Control Systems

STREAM: Module II March (Airframes & Engines) **Duration: 3 Hrs**

DAY/DATE: 04/04/2017 **TIME: 9-12 PM**

INSTRUCTION TO CANDIDATES

You should have the following for this examination:

i) Answer booklet
ii) Mathematical table/ scientific calculator

*Answer **ANY THREE QUESTIONS IN SECTION A** and **ALL IN-SECTION B** in this paper*

All questions carry equal marks.

Maximum marks for each part of a question are as shown

This paper consists of Five (5) printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A (Electronics)

Answer any THREE questions from this Section.

1. (a) Explain the salient feature of Bohr's atomic model. **(2 marks)**

   (b) Draw and explain the V-I characteristics of a *pn* junction. **(4 marks)**

   (c) With the aid of diagram explain the operation of a transistor as an amplifier **(6 marks)**

   (d) A transistor is connected in CE configuration in which collector supply is 8V and the voltage drop across resistance R_C connected in the collector circuit is 0.5V. The value of R_C= 800Ω. If $\alpha = 0.96$ determine;

   i. Collector- emitter voltage

   ii. Base current. (**8 marks)**

2. (a) Explain why is the energy of an electron more in higher orbits. **(2 marks)**

   (b) Explain the concept of energy bands in solids. **(4 marks)**

   (c) With the aid of diagram state **Three** possible transistor connection. **(6 marks)**

   (d) An n-p-n transistor at room temperature has its emitter disconnected. A voltage of 5V is applied between collector and base. With collector, positive, a current of 0.2 μA flows. When the base is disconnected and the same voltage is applied between collector and emitter, the current is found to be 20 μA. Find α, I_E and I_B when collector current is 1mA. (**8 marks)**

3. (a) Describe the following with the help of energy level diagram

   i. Valance band

   ii. Conduction band

   iii. Forbidden energy gap. **(6 marks)**

(b) Draw and explain the input and output characteristics of CB connection. **(4 marks)**

(c) Determine V_{CB} in the transistor circuit shown in the Figure 1. The transistor is of silicon and has $\beta = 150$. **(10 marks)**

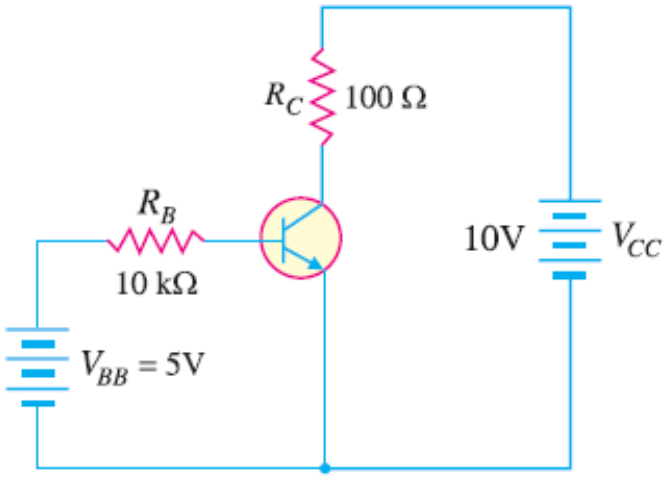


Figure 1

4. (a) Describe the following with the help of energy level diagram;

   i. Conductor

   ii. Insulator

   iii. Semiconductor. **(6 marks)**

   (b) Distinguish between the following term as applied in semiconductor;

   i. Intrinsic and Extrinsic

   ii. Majority and Minority Carriers. **(4 marks)**

   (c) Determine the Q point of the transistor circuit shown in Figure 2. Also draw the d.c. load line. Given β = 200 and VBE = 0.7V. **(10 marks)**

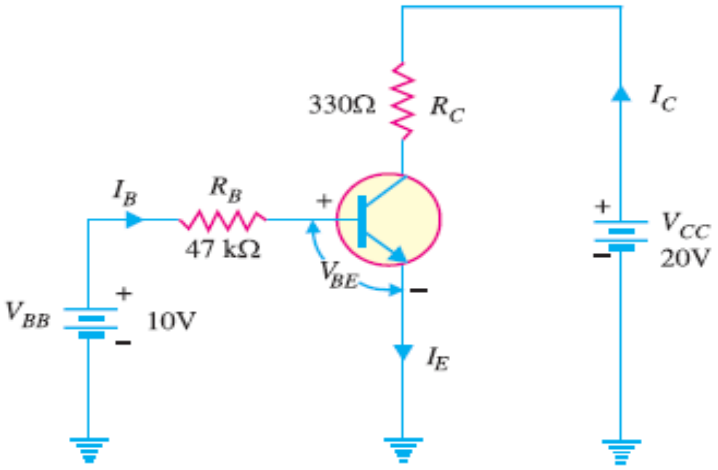


Figure 2

5. (a) State **Two** properties of semiconductors. **(2 marks)**

   (b) Discuss the effect of temperature on semiconductors. **(4 marks)**

   (c) Draw a transistor dc load line and explain the following terms;

   i. Q- point

   ii. Cut-off point

   iii. Saturation point. **(6 marks)**

   (d) With the aid of a diagram explain the principle of operation of the following devices;

   i. Zener Diodes

   ii. Bipolar Junction Transistor **(8 marks)**

SECTION B (Control Systems)

Answer ALL questions from this Section

6. a) Define the following terms as used in control systems: -

   i. Manipulated input. **(1 mark)**

   ii. Hybrid systems. **(1 mark)**

   iii. Actuator element. **(1 mark)**

   b) State any four advantages of a closed loop control system **(4 marks)**

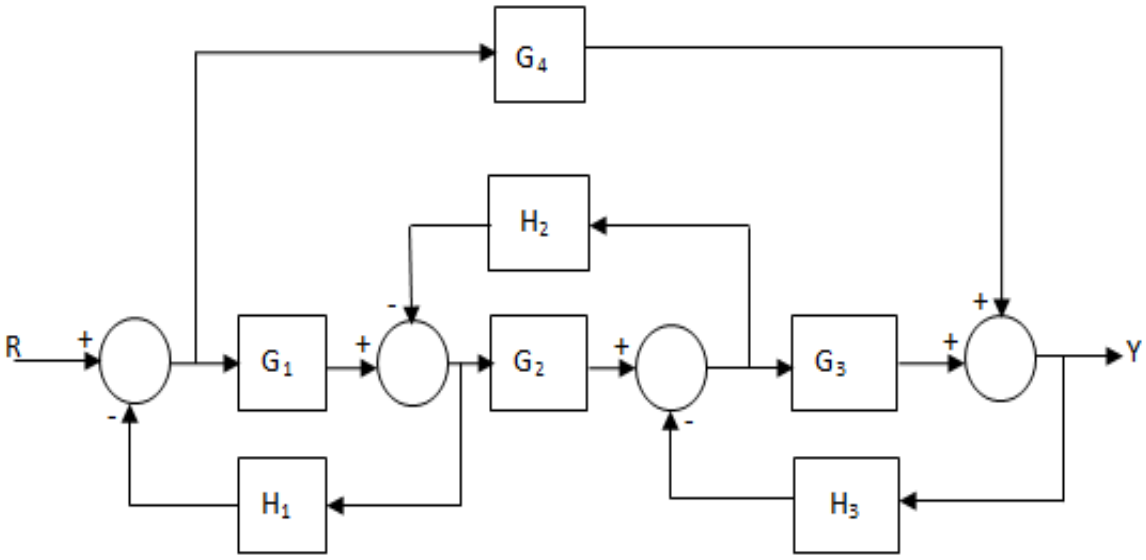
   c) From first principle, show that the overall transfer functions of closed loop system with positive feedback is given by: -

   $$\frac{X_S}{Y_S} = \frac{G(S)}{1-G(S)H(S)}$$ **(5 marks)**

   d) Draw a block diagram and state all the elements and signals of the basic structure of a feedback control system. **(8 marks)**

7. a) Reduce the following system into canonical form hence give the overall transfer function using: -

   i. Block reduction formula **(12 marks)**



b) State the following as used in control systems: -

i. Superposition. **(2 mark)**

ii. Node. **(2 mark)**

iii. Branch. **(2 mark)**

iv. Block. **(2 mark)**

******End******