EAST AFRICAN SCHOOL OF AVIATION EXAMINATION

END TERM I EXAMS

DIPLOMA IN AERONAUTICAL ENGINEERING AVIONICS

TELECOMMUNICATION PRINCIPLES

STREAM: **Duration:**

DAY/DATE: **TIME:**

INSTRUCTION TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Mathematical tables/ Electronic calculator.

Answer ***QUESTIONS 1 AND ANY OTHER 4 QUESTIONS*** *in this paper*

All questions carry equal marks.

Maximum marks for each part of a question are as shown

This paper consists of Six (6) printed pages.

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

1. (a) (i) State any three advantages of single-ended as compared to push pull operation amplifier. **3 marks**

(ii) Explain how cross over distortion occurs in supplementary – symmetry push – pull amplifier. **3 marks**

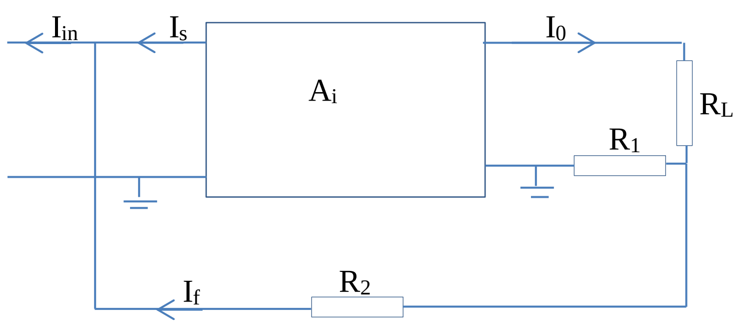
(iii) Figure 1 below shows a block diagram of a negative feedback amplifier. Show that the current gain is given by the expression:- **6 marks**

$$A_{if} = \frac{A_i}{1+\beta A_i}$$

Where: A_{if} = Gain with feedback

A_i = Gain without feedback

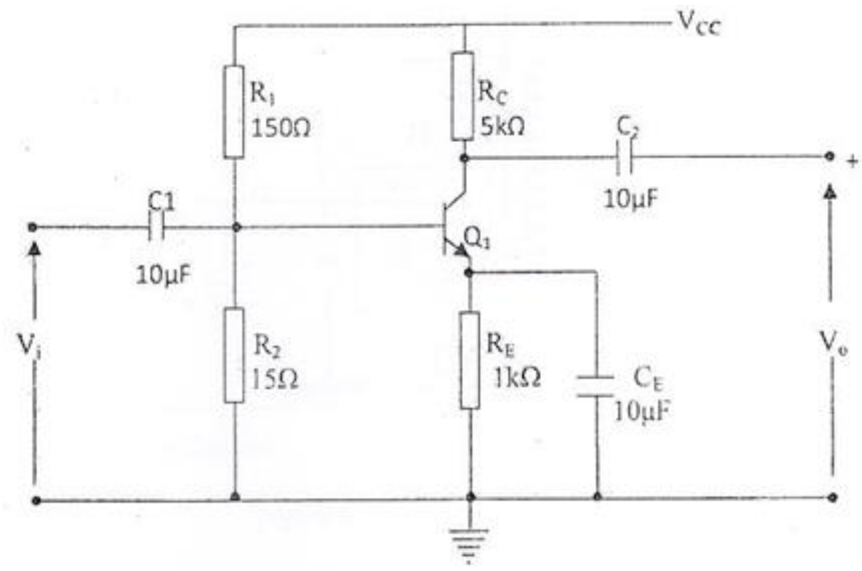
β = feedback factor



2. (a) Figure 2 below shows a common – emitter amplifier.

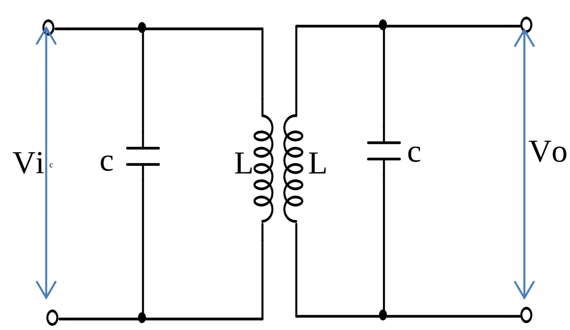
i. Draw the h – parameters equivalent circuit. **4 marks**

ii. From the equivalent circuit in Q2 (a) (i) determine the voltage given that h_{ie} = 1.5kΩ and h_{fe} = 80. Neglect h_{oe} and h_{re}. **4 marks**



(b) Sketch the primary current/frequency characteristic curve of loosely coupled circuit and explain its shape. **3 marks**

(c) Figure 2 (b) below shows an I.F transformer with identical primary and secondary tuned circuits. The inductance L is 500μF and the 3dB bandwidth is 16 kHz centered on 450 kHz. For critical coupling conditions, determine the:



i. Coefficient of coupling; **2 marks**

ii. Mutual inductance between the windings; **3 marks**

iii. Q –factor of each windings; **2 marks**

iv. The value of tuning capacitor C. **2 marks**

3. (a) Sketch the diagram of class A power amplifier and its V/I characteristic and from first principle show that its maximum collector efficiency is 50%. **8 marks**

(b) For a class B amplifier using a supply of V_{cc} = 12 Volts and driving a load of 8Ω, determine:-

i. Maximum load power **2 marks**

ii. Dc input power **2 marks**

iii. Collector efficiency **2 marks**

(c) Measurement for harmonic distortion component in a power amplifier gave the following results. $D_2 = 0.1$, $D_3 = 0.01$ and $D_4 = 0.02$. If the fundamental component of the distorted current is 4A and the collector resistance is 10Ω, determine:-

i. The total harmonic distortion **2 marks**

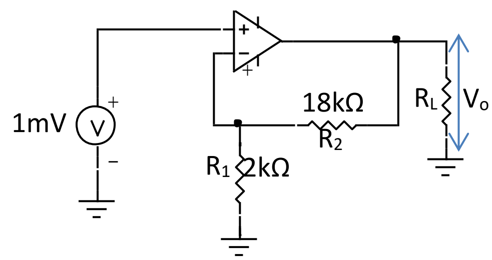
ii. The fundamental power component **2 marks**

iii. The total power **2 marks**

4. (a) State **FIVE** advantages of negative feedback amplifier. **5 marks**

(b) Using a suitable diagram, show that a negative feedback amplifier increases input impedance and decreases output impedance. **9 marks**

(c) Figure below shows the negative voltage feedback amplifier. If the gain of the amplifier without feedback is 10000, find:-



i. Feedback fraction **2 marks**

ii. Overall voltage gain **2 marks**

iii. Output voltage if the input voltage is 1 mV **2 marks**

5. a) State any six advantages of electronic oscillators **3 marks**

b) Using a suitable diagram, explain the operation of positive feedback amplifier oscillator and hence state Barkhausen Criterion. **3 marks**

c) Draw a circuit diagram of a Colpitt's oscillator and describe its operation.

5 marks

d) The oscillator in QC above has an inductor of 1 mH available. Choose the capacitor values so that the frequency f=1 MHz and the feedback fraction $M_v = 0.25$ **5 marks**

e) Using some illustrations, describe TWO types of sinusoidal oscillators **4 marks**

6. a) Draw a circuit diagram of a transistor R-C phase shift oscillator and explain is operation. **5 marks**

b) The oscillator in Qa above has a collector resistor, $R_c = 10k\Omega$, resistance seen looking into the base, $R=1M\Omega$ and phase shift capacitors $C_1 = C_2 = C_3 = C = 68pF$. At what frequency does the circuit oscillate? **3 marks**

c) Also from the same oscillator, derive or show that the frequency of oscillation is given by the equation:- $f=1/(2\pi RC\sqrt{6})$ **7 marks**

d) Differentiate between an electronic oscillator and an alternator. **5 marks**

7. a) Explain a complementary symmetry amplifier using a circuit diagram and hence state two advantages and two disadvantages of the amplifier **(11marks)**

b) Draw class A power amplifier and hence show that its maximum collector efficiency is given as 50% **(9marks)**

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