TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS 2016/2017

FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 2315: ANALOGUE ELECTRONICS IV

END OF SEMESTER EXAMINATIONS

SERIES: MAY, 2016

TIME: 2 HOURS **PAPER 1**

INSTRUCTIONS:

1. You should have the following for this examination:
   - Answer booklet
   - Non-Programmable Scientific calculator
2. This paper consists of **FIVE** questions
3. Answer **Question ONE and any other TWO** Questions.
4. All questions carry equal marks
5. Do not write on the question paper.

5. This paper consists of FOUR printed pages.

Question ONE

(a) (i) Differentiate between Class A and Class B amplifier.

(ii) State **THREE** advantages and **THREE** disadvantages of using Class B amplifier as compared to Class A.

(4.5 marks)

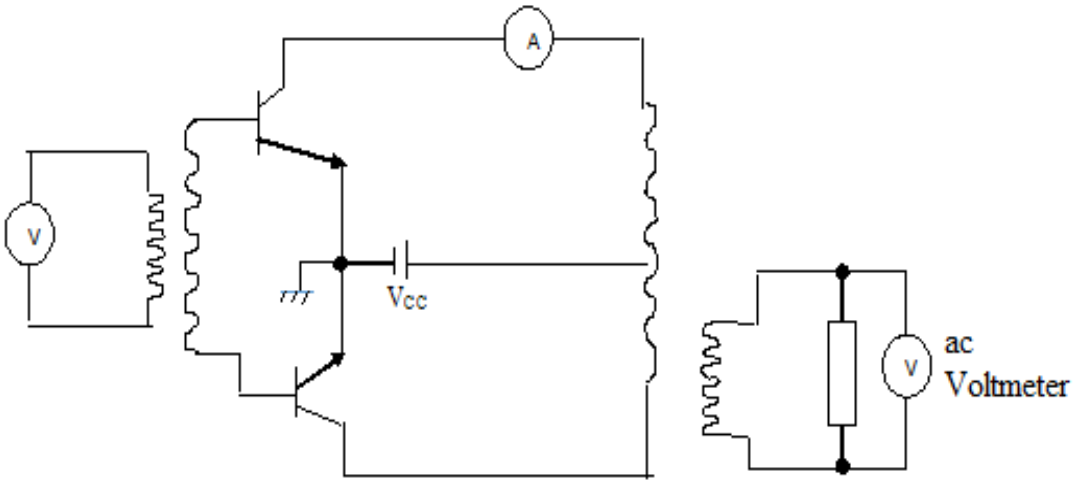
(b) Using suitable diagrams show that the maximum conversion efficiency of Class B push-pull amplifier is 78.5%. **(15 marks)**

(c) In the ideal Class B push-pull amplifier shown in Figure Q1, the d.c. ammeter reads 2 amps and the a.c. voltmeter across the load reads 12Vrms under full load condition. Find:

(i) Output power
(ii) Turns ratio
(iii) V_{cc}

(iv) I_{cmax} and I_{CQ}

(v) P_{dmax} and P_{ac}



(10.5 marks)

Figure Q1

Question TWO

(a) Design an audio amplifier with a pass band of 20Hz to 20kHz and a mid-band gain of 64000. The amplifier should have 3 stages used in cascade. **(4.5 marks)**

(b) When a transistor is biased at 10mA, 10V, it has the following h-parameters at room temperature. $h_{ie} = 500\Omega$, $h_{fe} = 100$, $h_{re} = 10^{-4}$, $h_{oe} = 4 \times 10^{-5}$mho. It has $f_T = 50$MHz and $C_{ob} = 3$pF. Find the values of all hybrid π components.

(9.5 marks)

(c) (i) Name the types of distortion that may exist either separately or simultaneously in an amplifier.

(ii) Briefly describe the distortions in (c)(i) above.

(6 marks)

Question THREE

(a) (i) Design a push-pull class B amplifier to achieve maximum power output to 10Ω load. Specify V_{cc}, N and a bias network to eliminate cross-over distortions. Use transistors with rating $Pd_{(max)} = 4$W; $BV_{CEO} = 40$V, $I_{Cmax} = 1$A.

(ii) Calculate the maximum power output of the amplifier in (i).

(iii) Compare the power attained when using push-pull as opposed to a single transistor without maximum rating.

(8 marks)

(b) A parallel resonant circuit has a capacitor of 100pF in one branch and an inductance of 100μH plus a resistance of 10Ω in the parallel branch. If the supply, voltage is 100V, calculate f_r, I_L, I_C, line current and impedance of the resonant circuit at resonance. Also determine Q. **(12 marks)**

Question FOUR

(a) (i) Draw **TWO**-stage RC-coupled amplifier.

(ii) Derive an expression for the overall gain of the two-stage RC-coupled amplifier in the mid frequency range.

(15 marks)

(b) In a multi-stage transformer coupled amplifier, the output impedance of the first stage is 5k and the input impedance of the second stage is 1k. Determine the primary and secondary inductances of the transformer for perfect impedance matching at f = 2,000Hz. If one turn given an inductance of 10μH, find the number of primary and secondary turns.

(5 marks)

Question FIVE

(a) In an amplifier the maximum voltage gain is 2500 and occurs at 1.5kHz. It falls to 1414 at 5kHz and 50Hz. Find:

(i) Bandwidth
(ii) Lower cut-off frequency
(iii) Upper cut-off frequency

(5.5 marks)

(b) The Thevenin source resistance at input an amplifier is 5kΩ Figure Q5. Estimate the amount of noise this resistance delivers to the amplifier whose bandwidth is 100kHz, given that $T = 25^{o}$and $k = 1.37 \times 10^{-23}$.

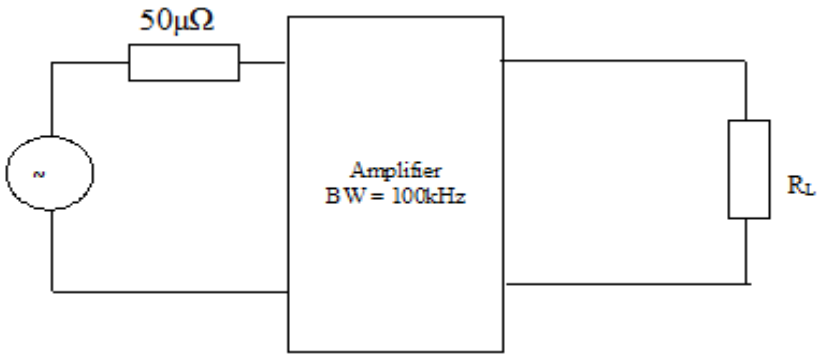


Figure Q5

(1.5 marks)

(c) (i) Draw hybrid π model of CE of a transistor with a load resistance R_L connected across C and E terminals.

(ii) Using Miller's theorem derive an expression for the current gain of (c)(i) above.

(13 marks)