NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JANUARY/FEBRUARY 2013 EXAMINATION

COURSE CODE: **PHY 308**

COURSE TITLE: **ELECTRONICS I**

CREDIT UNIT: **3**

INSTRUCTION: **Answer any five questions.**

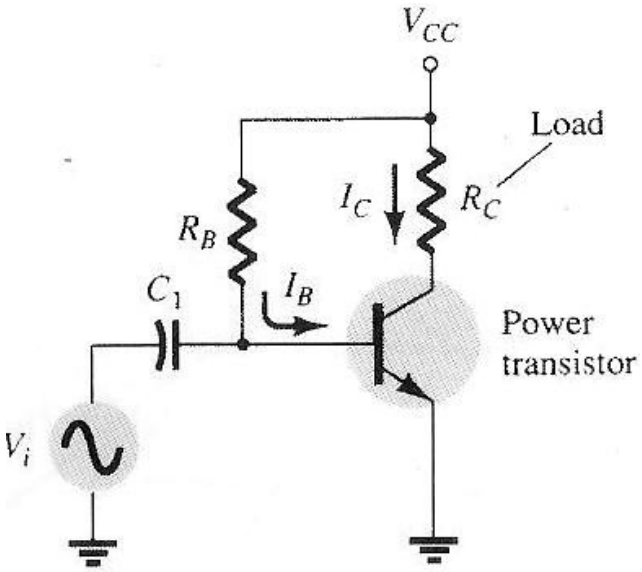
TIME: **3 Hours**

1. (a) (i) What is an amplifier? List the main properties of an amplifier and draw a simple circuit diagram of an ideal amplifier to show the relationship among these properties. 5 marks

(ii) Determine the Voltage, Current and Power Gain of an amplifier that has an input signal of $1\,mA$ at $10\,mV$ and a corresponding output signal of $10\,mA$ at $1\,V$. Also, express all three gains in decibels, (dB).
5 marks

(b) (i) Distinguish between the A and B classes of amplifier. With sketch transfer characteristic curves, show the relationship between the input and the output signals of each class. State an advantage of one class over the other.
5 marks

(ii)



Series-fed class A large signal amplifier

The figure shown is a circuit diagram for a series-fed class A large signal amplifier. Given $R_B=1k\Omega$, $R_C=20\Omega$ $V_{CC}=20V$ and $\beta=25$, calculate V_{CE}.
5 marks

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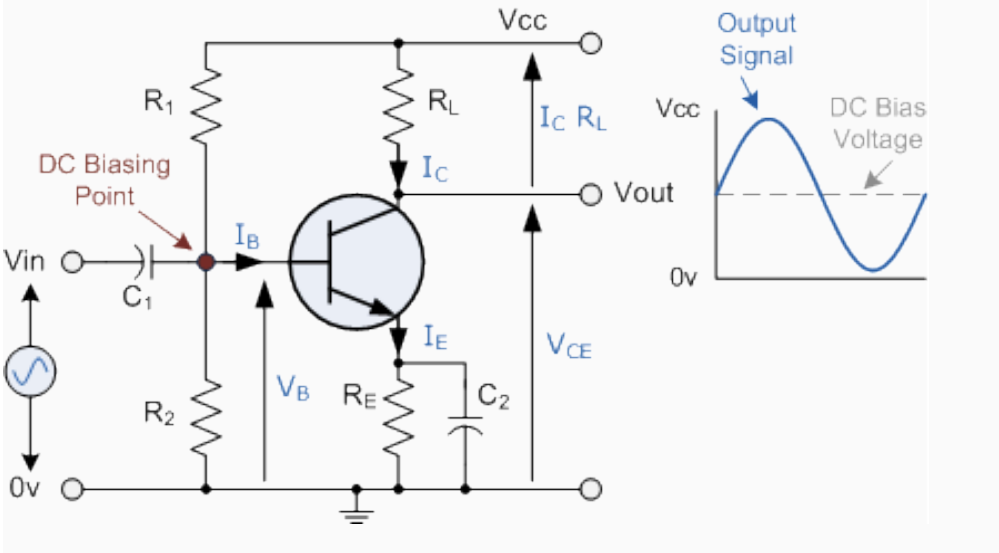
2. (a) (i) A transistor is a three-terminal device. With suitable diagrams, explain briefly the three main transistor configurations (connection in a practical circuit) for an NPN transistor. 6 marks

(ii) Show that the current amplification factors α and β are related by the equation $\beta=\frac{\alpha}{1-\alpha}$ where the symbols have the usual meaning
4 marks

(b)



Circuit diagram for question 2 b

For the emitter bias circuit shown, calculate the values of R_1, R_2 and R_E to provide a quiescent operating point of $I_C=1mA$ $V_{CE}=10V$. The transistor used in the circuit is silicon with a d.c. current gain at 1 mA of $h_{FE}=50$. Assume the base-emitter voltage $V_{BE}=16V$. The load resistor and collector supply voltage for the circuit are $R_L=5k\Omega, V_{CC}=15V$ 10 marks

3. (a) Given I_E= 2.5 mA, h_{fe} = 140, h_{oc} = 20 μS (µmho) and h_{ob} = 0.5 μS, determine:

(i) The common-emitter hybrid equivalent circuit. 5 m s

(ii) The common-base r_e model 5 ks

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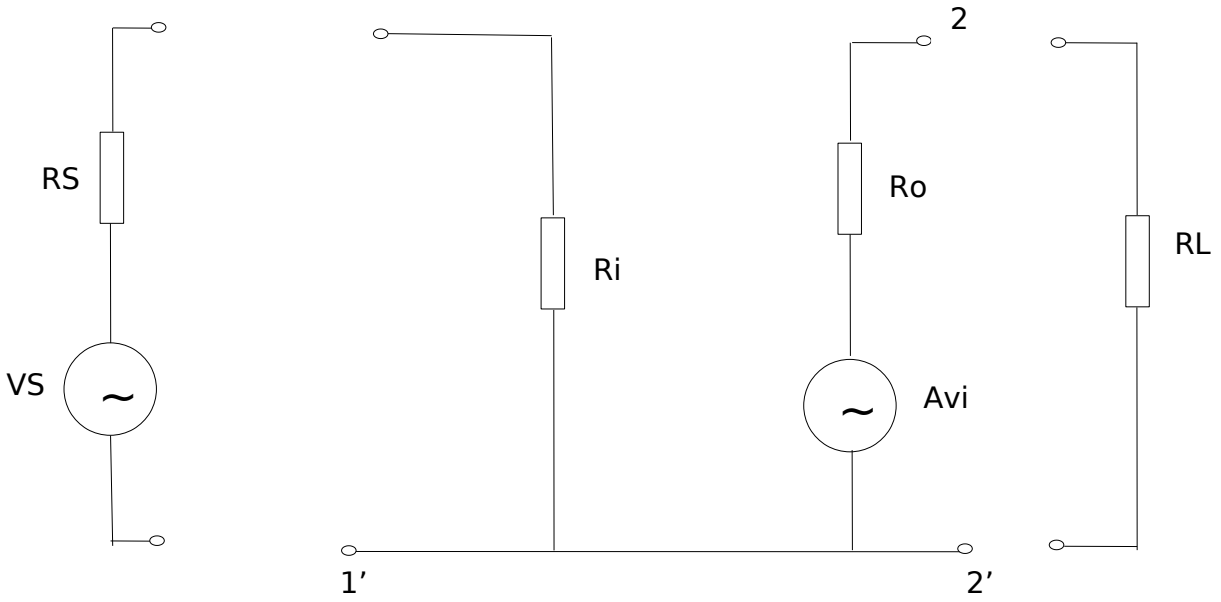
(b) 1



Circuit diagram for questions 3b

The figure shows an a.c. equivalent circuit of an amplifier. The input and output of the amplifier have values R_i = 5 kΩ, R_o = 50 kΩ . The open-circuit voltage amplification of the amplifier, A = 250. If the signal generator of peak amplitude V_s = 10 mV and internal resistance R_s = 600Ω is connected cross the input terminals 1-1' and a load resistance R_L = 10kΩ is connected across the output terminals 2-2', use the equivalent circuit to determine:

(i) peak value of the signal voltage across 1-1',
5 marks **(ii) the peak values of the signal output current and signal voltage**
5 marks

4 (a) (i) Complete the following table of h-parameter

Parameter	**Meaning**	**Relation**	**Condition** **Unit**
h_{11}			**Output shorted** **Ohm**
	Reverse voltage gain	$\frac{V_i}{V_o}$	**d** **imensionless**
h_{21}	**Current gain**	$\frac{I_o}{I_i}$	

h_{22}	$\frac{I_o}{V_o}$	**Input open**

4 marks

(ii) List four factors on which the h-parameter depend
2 marks

(b) Given I_E= 2.5 mA, h_{fe} = 140, h_{oc} = 20 μS (µmho) and h_{ob} = 0.5 μS, determi

(i) The common-emitter hybrid equivalent circuit **8 marks**

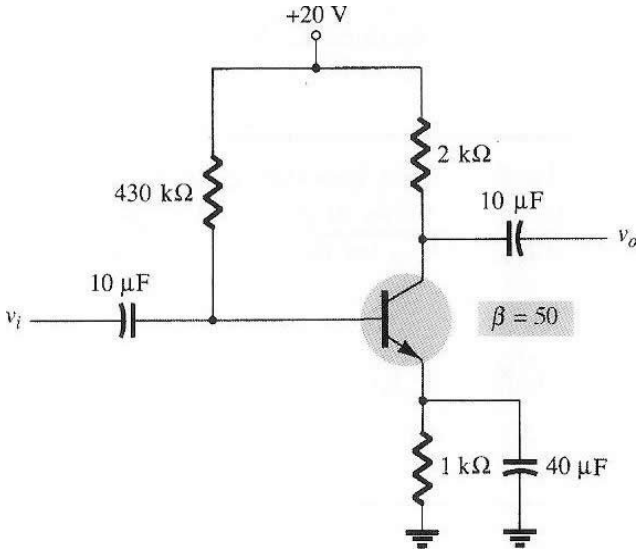
(ii) The common-base r_e model
6 marks

5 (a) (i) Briefly explain the term *operating point*
3 marks

(ii) Summarize the operation in the cutoff, saturation, and linear regions of the BJT characteristic.

5 marks

(b)



For the emitter bias network shown determine: I_B, I_c, V_{CE}, V_C, V_E, V_B, V_{BC}. 12 marks

6(a) (i) What is an *oscillator*?
2 marks

(ii) Briefly, distinguish between positive and negative feedback as applied to an oscillator. 6 marks

(b) (i) Draw the circuit diagram for closed-loop non-inverting operational amplifier. 4 marks (ii) For the closed-loop non-inverting operational amplifier, show that $A' = \frac{R_i + R_f}{R_i}$**, where the** A' **is the voltage gain.** $R_i \wedge R_f$ **are the resistances in the input and feedback paths respectively. 8 marks**

7 (a) (i) Explain the usefulness of a rectifier circuit in a dc supply unit 2marks

(ii) Draw the circuit diagram of the half-wave rectifier circuit and indicate the respective input and output waveforms
7 marks (b) (i) A half-wave rectifier using silicon diode has a secondary emf **of** $14.14\,V\,(rms)$ **with a resistance of** $0.2\,\Omega$**. The diode has a forward resistance of** $0.05\,\Omega$ **and a threshold voltage of** $0.7\,V$**. If load resistance is** $10\,\Omega$**, determine: dc load current, dc load voltage, voltage regulation and efficiency.**

6 marks

(ii)Draw the diagram of the full-wave rectifier circuit using the centre-tapped transformer and briefly explain how it works.
5 marks