

PROGRAM : NATIONAL DIPLOMA
ENGINEERING: COMPUTER SYSTEMS
ENGINEERING: ELECTRICAL

SUBJECT : **ELECTRONICS II**

CODE : **EEL2211**

DATE : SUMMER SSA EXAMINATION 2017
11 JANUARY 2017

DURATION : (SESSION 1) 08:00 - 11:00

WEIGHT : 40 : 60

FULL MARKS : 100

TOTAL MARKS : 100

EXAMINER : DR THOKOZANI C SHONGWE

MODERATOR : MR PJJ VAN ZYL 2024

NUMBER OF PAGES : 8 PAGES, 1 ANSWER SHEET, 1 GRAPH PAPER AND 2 SEMI-LOG GRAPH PAPERS

INSTRUCTIONS : CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)
: USE ONLY THE ANSWER SHEET PROVIDED WITH THIS PAPER

REQUIREMENTS : 1 LINEAR GRAPH PAPER
: 2 SEMI-LOG GRAPH PAPERS

INSTRUCTIONS TO CANDIDATES:

1. 100 MARKS = 100%
 2. ATTEMPT ALL QUESTIONS.
 3. THEORY TYPE QUESTIONS MUST BE ANSWERED IN POINT FORM BY CAREFULLY CONSIDERING THE MARK ALLOCATION.
 4. QUESTIONS MAY BE ANSWERED IN ANY ORDER, BUT ALL PARTS OF QUESTION MUST BE KEPT TOGETHER.
 5. ALL DIAGRAMS AND SKETCHES MUST BE DRAWN NEATLY AND IN PROPORTION.
 6. ALL DIAGRAMS AND SKETCHES MUST BE LABELLED CLEARLY.
 7. ALL WORK DONE IN PENCIL EXCEPT DIAGRAMS AND SKETCHES WILL BE CONSIDERED AS ROUGH WORK.
 8. NOTE: MARKS WILL BE DEDUCTED FOR WORK WHICH IS POORLY PRESENTED.
 9. ~~NEGATIVE MARKING APPLIES IF YOUR ANSWER DOES NOT COMPLY WITH THE DETAIL REQUIRED AS REQUESTED IN CERTAIN QUESTIONS.~~
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QUESTION 1

- 1.1 The input impedance of a BJT is
 - a) Inductive
 - b) Capacitive
 - c) Resistive
 - d) Resistive and capacitive
 - e) Resistive and inductive
- 1.2 The output impedance of a BJT is
 - a) Inductive
 - b) Capacitive
 - c) Resistive
 - d) Resistive and capacitive
 - e) Resistive and inductive
- 1.3 For BJT amplifiers, the no-load voltage gain is
 - a) Less than the loaded voltage gain
 - b) Equal to the loaded voltage gain

- c) Greater than the loaded voltage gain
 - d) Equal to zero
- 1.4 Depending on configuration, the magnitude of the voltage gain for a loaded BJT amplifier ranges from
- a) Just less than 1 to a few hundred
 - b) Zero to 10,000
 - c) 1 to 10,000
 - d) 10 to 1000
 - e) None of the above
- 1.5 BJT amplifiers current gain will typically range from
- a) Just less than 1 to just exceed 100
 - b) Zero to 10,000
 - c) 1 to 10,000
 - d) 10 to 1000
 - e) None of the above
- 1.6 The "re" transistor model replaces the _____ with
~~the junction diode's ac resistance.~~
- a) Collector-base junction
 - b) Collector-emitter junction
 - c) Emitter-base junction
 - d) All of the above
- 1.7 For the common-base configuration, the typical value of the input impedance range is
- a) 2 to 50 Ohms
 - b) 50 to 1000 Ohms
 - c) 100 to 10,000 Ohms
 - d) 1 M Ohms to 2 M Ohms
 - e) None of the above

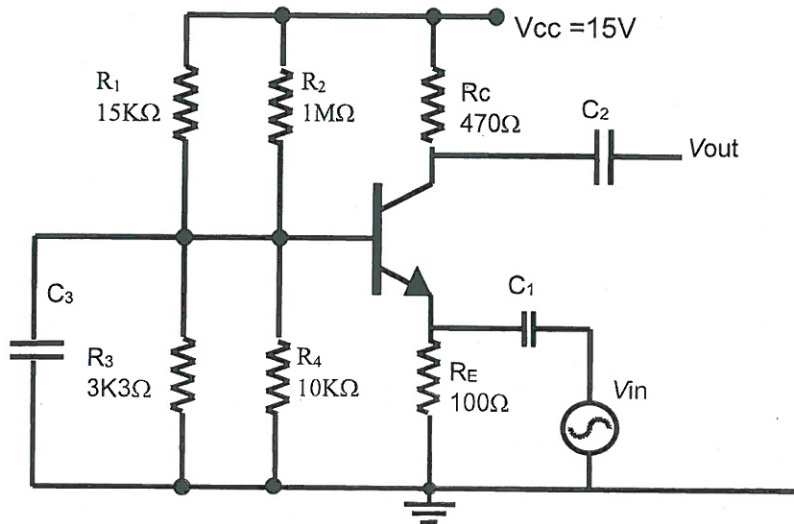
- 1.8 For the common-base configuration, a typical value of the output impedance range is
- a) 2 to 50 Ohms
 - b) 50 to 1000 Ohms
 - c) 100 to 10,000 Ohms
 - d) 1 M Ohm to 2 M Ohms
- 1.9 The input impedance of the common-emitter configuration is
- a) Inversely related to the transistor β
 - b) Directly related to the transistor β
 - c) Equal to the transistor β
 - d) None of the above
- 1.10 The common-emitter configuration has a current gain that is equal to
- a) $\frac{1}{2}\beta$
 - b) β
 - c) 2β
 - d) 20β
 - e) None of the above
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- 1.11 What is the average voltage of the waveform $V(t) = 10\sin(10t)$
- a) 10 V
 - b) 0 V
 - c) 5 V
 - d) 2 V
- 1.12 The input voltage, $V_{in} = 20\pi \sin(100t)$ passes through a half-wave rectifier. What is the DC value at the output of the half-wave rectifier?
- a) 5 V
 - b) 10 V
 - c) 15 V
 - d) 20 V
- 1.13 The input voltage, $V_{in} = 32.57 \cos(100t)$ passes through a full-wave rectifier. What is the RMS value of the ripple voltage at the output of the full-wave rectifier?
- a) 5 V
 - b) 10 V
 - c) 15 V
 - d) 20 V

- 1.14 The input voltage, $V_{in} = 20\pi \sin(100t)$ passes through a half-wave rectifier with a load resistor $R_L = 10 \Omega$. What is the efficiency of the half-wave rectifier?
- a) 10.4 %
 - b) 81.2 %
 - c) 40.6 %
 - d) 35.3 %
- 1.15 For a particular design the _____ the value of $R(L)$, the _____ the value of the small signal voltage gain.
- a) larger, smaller
 - b) smaller, smaller
 - c) smaller, larger
 - d) none of the above
- 1.16 The common-emitter amplifier has
- a) Voltage gain, current gain and power gain
 - b) Voltage gain and power gain, but no current gain
 - c) Current gain and power gain, but no voltage gain
 - d) Current gain and voltage gain, but no power gain
- 1.17 A Fixed-bias BJT circuit has values of $H_{FE} = 200$ and $h_{fe} = 120$. The ac current gain for the device is
- a) 200
 - b) 120
 - c) 24,000
 - d) 320
- 1.18 Coupling capacitors are chosen to ensure that the values of X_C are _____ at the amplifier's operating frequency.
- a) Very small
 - b) Small
 - c) Large
 - d) Very large
- 1.19 A CE amplifier has values of $V_E = 1.1 \text{ V}$, $r_e = 1 \text{ K Ohms}$ and $R_C = 10 \text{ k ohms}$. What is the value of the voltage gain for the circuit
- a) 10
 - b) 110

- c) 484
d) Cannot be determined with the information given
- 1.20 A transistor amplifier has an input signal applied to its emitter terminal and an output signal taken from its collector terminal. The amplifier is a
- a) Common-emitter amplifier
b) Common-base amplifier
c) Common-collector amplifier
d) Emitter follower
- 1.21 A voltage regulator: _____
- a) maintains a constant power supply dc output voltage
b) limits the primary voltage of a power supply transformer
c) reduces the power supply ripple output voltage
d) none of the above
- 1.22 The ideal voltage regulator maintains a constant dc output voltage regardless of change in _____
- a) its input voltage
b) its output voltage demand
c) its load current demand
d) either its load current demand or its input voltage
- 1.23 A rectified dc voltage was measured with both an ac and a dc voltmeter. It was found that $V_{dc} = 50 \text{ V}$ and $V_{ac} = 2.16 \text{ V rms}$. What was the percent ripple?
- a) 6 %
b) 4.32 %
c) 0.432 %
d) 0.86 %
- 1.24 A capacitive filter is added to a half-wave rectifier. The initial value of capacitance is $22 \mu\text{F}$. If this value is increased to $100 \mu\text{F}$, the ripple output from the circuit will
- a) increase
b) decrease
c) remain the same
d) cannot be predicted

QUESTION 2

Use the figure below of a common base amplifier circuit to



- 2.1. Draw and label a complete circuit of the h-parameter small signal model of the circuit above. All four h-parameters must be clearly indicated. (10)
- 2.2 Give expressions for the following:
- 2.2.1 Input impedance (Z_i) (3)
 - 2.2.2 Output impedance (Z_o) (3)
 - 2.2.3 Voltage gain (A_v) (3)
 - 2.2.4 Current (A_i) (2)
 - 2.2.5 Power gain (A_p) (2)

[23]

QUESTION 3

Consider a voltage-divider common source amplifier circuit for an N-channel JFET. The following information regarding the JFET amplifier is relevant:

$I_{DSS} = 10\text{mA}$, Y_{os} = may be ignored, $V_{GS\text{ off}} = -4\text{V}$ (V_p) and the supply voltage is 20V.

The resistors that form the voltage divider, provides a dc gate voltage $V_g = 4\text{V}$.

The value of the source resistance $R_s = 1\text{k}\Omega$ (bypassed by a capacitor) and the value of drain resistance $R_D = 10\text{k}\Omega$.

Answer the following questions regarding the amplifier:

- 5.1 Sketch a fully labelled diagram of the circuit. (2)
- 5.2 Determine the operating points (I_{DQ} and V_{GSQ}) graphically by making use of the sheet of graph paper (to be handed in with your answer script). (13)
- 5.3 Sketch the fully labelled small-signal equivalent model of the amplifier. (2)
- 5.4 Determine the voltage gain of the amplifier. (6)

[23]

QUESTION 4

Consider an RC high pass filter with $C = 1\ \mu\text{F}$ and cut-off frequency $f_c = 50\text{ Hz}$.

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- 4.1 Calculate the value of R to be used. (2)
 - 4.2 Give a sketch of the filter showing all components and their values (3)
 - 4.3 Calculate the output voltage V_o , for $f_1 = 100\text{ Hz}$ and $f_2 = 1000\text{ Hz}$. What do you observe? (3)
 - 4.4 On the semi-log graph papers provided, plot the frequency response of the:
 - 4.4.1 Voltage gain in decibels (A_v (dB)) (11)
 - 4.4.2 Phase in degrees. (11)

The frequency should be in Hertz (Hz).

[30]

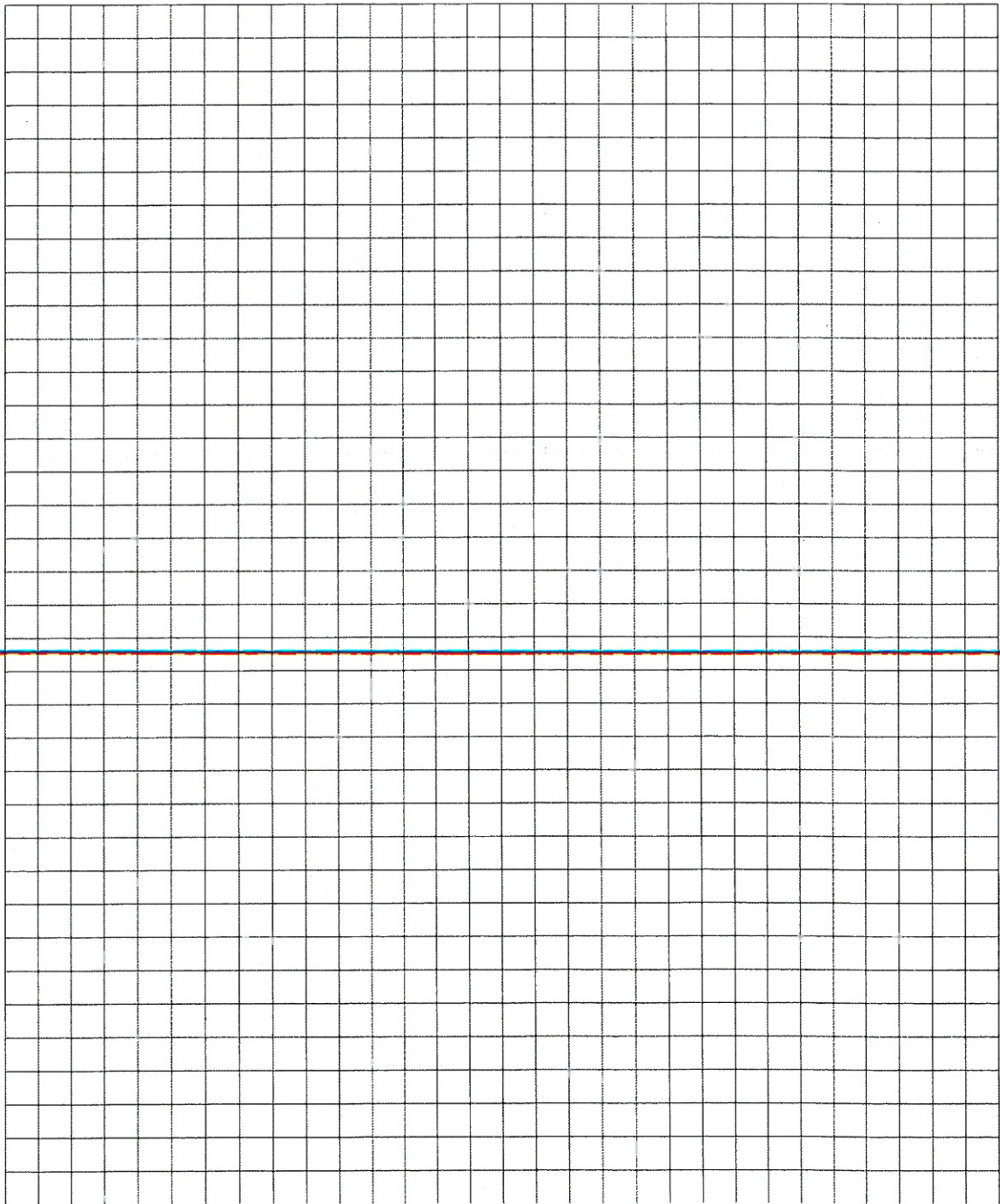
TOTAL MARKS : 100

STUDENT NAME: _____

STUDENT NUMBER: _____

ANSWER SHEET FOR QUESTION 1

| QUESTION | ANSWER | | | |
|----------|--------|---|---|---|
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((Place this answer sheet into your script))

