KISII UNIVERSITY
UNIVERSITY EXAMINATIONS
SECOND YEAR EXAMINATION FOR THE AWARD OF
THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND SOFTWARE ENGINEERING

FIRST SEMESTER 2021/2022
(FEBRUARY – JUNE, 2022)

PHYS 213: INTRODUCTION TO ELECTRONICS

STREAM: Y2 S1   **TIME: 2 HOURS**

DAY: WEDNESDAY, 12:00 PM – 2:00 PM   **DATE: 11/05/2022**

INSTRUCTIONS

1. *Do not write anything on this question paper.*
2. *Answer Question ONE and any other TWO questions.*

QUESTION ONE (30 MARKS)

a) Explain the superposition theorem

(4 marks)

b) Differentiate between active filters and passive filters

(4 marks)

c) A filter section is required to pass all frequencies above 25 kHz and to have a nominal impedance of 600Ω. Design;
   (a) a high-pass T-section filter, and   (6 marks)
   (b) a high-pass π-section filter to meet these requirements.   (6 marks)

d) A transistor has β_{dc} =150 and I_B=75µA. Calculate I_c

(4 marks)

e) Explain the following
   i. Attenuation (2 marks)
   ii. Two port networks (2 marks)
   iii. cut-off frequency (2 marks)

QUESTION TWO (20 MARKS)

a) Explain the voltage ampere characteristic curve of a diode using an appropriate diagram.

(6 marks)

b) For the circuit shown below calculate;
   (i) the current drawn from the source,
   (ii) the p.d. across each resistor,
   (iii) the current through each resistor, and
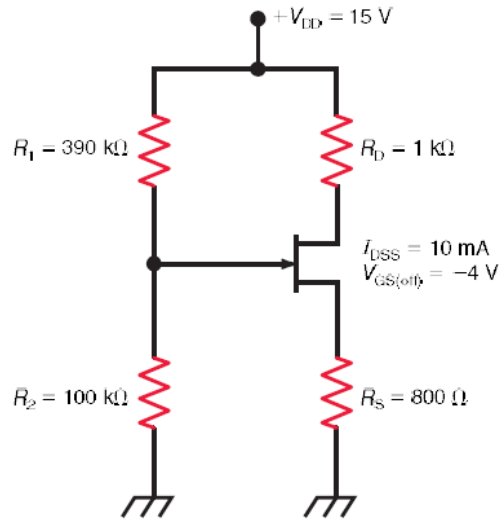   (iv) the power dissipated by the 5 Ω resistor.
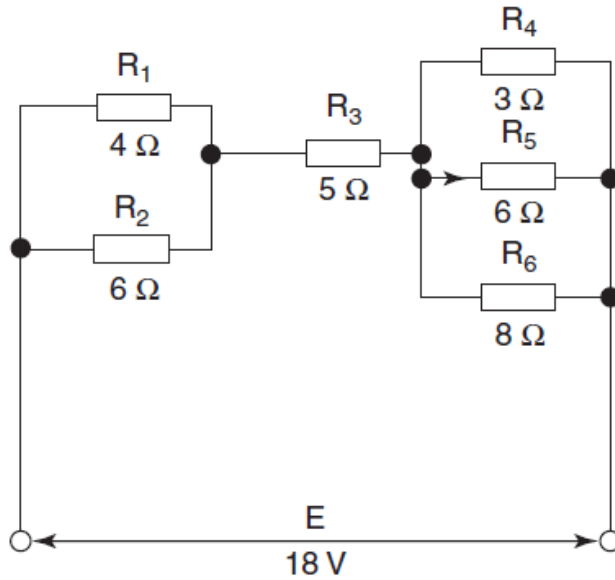
(8 marks)

c) Calculate f_{max} for an op-amp that has an S_R of 5V/μs and a peak output voltage of 10V. Also comment about its slew rate distortion.
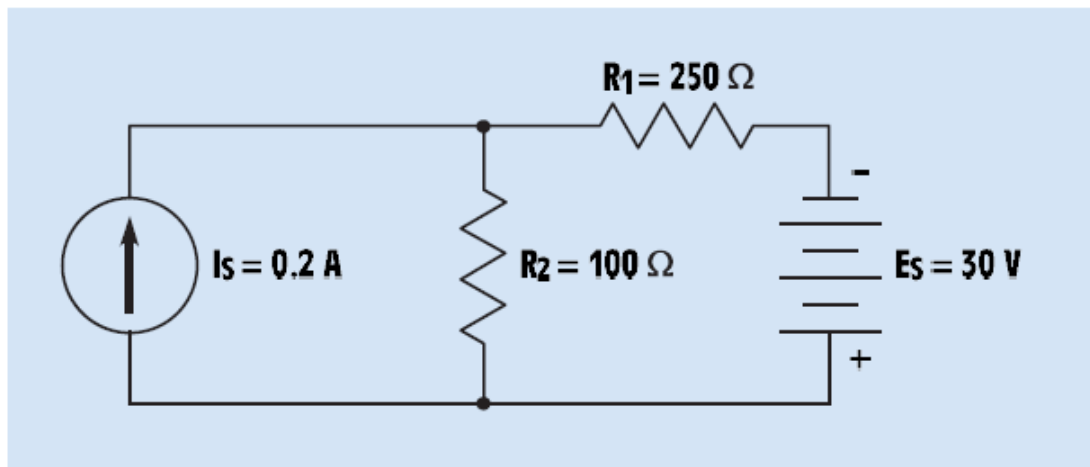
(6 marks)

QUESTION THREE (20 MARKS)

a) In the voltage divider bias JFET circuit below, V_{GS} = -1 V, Calculate V_G, V_S, I_D and V_D.

b) The circuit below contains a voltage source of 30V and a current source of 0.2A. Calculate the amount of current flowing through R2
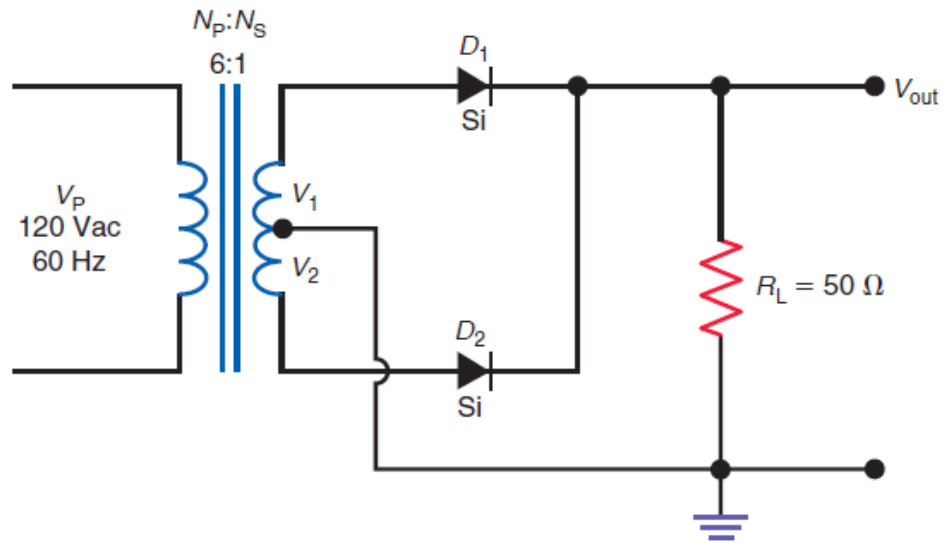

(10 marks)

QUESTION FOUR (20 MARKS)

a) Using the second diode approximation, for the figure below, calculate the following;

    i. $V_{out(pk)}$
    ii. V_{dc}
    iii. I_L
    iv. I_{diode}
    v. PIV for D_1 and D_2, and
    vi. f_{out}.

(10 marks)

b) Explain the working of a half wave rectifier.

(4 marks)

c) Explain the characteristics and purpose of each of the following regions in a transistor:
   i. emitter.
    ii. base.
    iii. collector.

(6 marks)

QUESTION FIVE (20 MARKS)

a) Explain the process of doping a semiconductor to produce and n-type and p-type material.

(4 marks)

b) For the voltage divider bias circuit shown in the figure below, solve for V_B, V_E, I_C, V_C and V_{CE}. Also, calculate $I_{C(sat)}$ and $V_{CE(off)}$. Finally, construct a dc load line showing the values of $I_{C(sat)}$, $V_{CE(off)}$, I_{CQ} and V_{CEQ}.

$+V_{CC} = 15$ V

$R_1 = 27$ kΩ

$R_C = 1$ kΩ

$\beta_{dc} = 100$

$R_2 = 5.1$ kΩ

V_B

V_E

$R_E = 240$ Ω
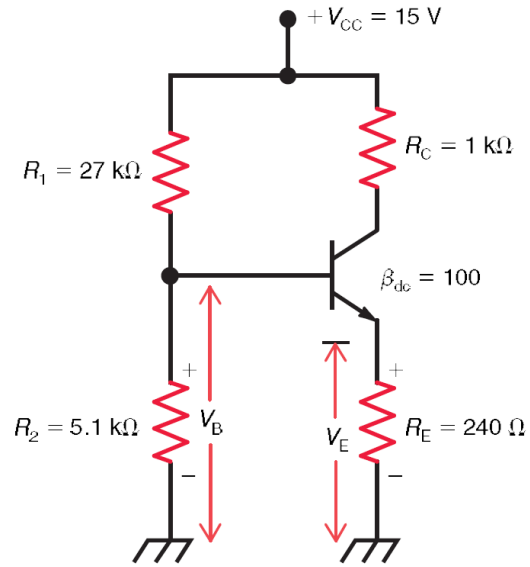
(12 marks)

c) Distinguish between a low pass and high pass filters.

(4 marks)