NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JUNE/JULY EXAMINATION

COURSE CODE: PHY308
COURSE TITLE: ELECTRONICS I
TIME ALLOWED:3 Hours
INSTRUCTION: ANSWER QUESTION ANY FIVE QUESTIONS

QUESTION ONE

a.

A junction transistor whose parameters are r_{11}= 820Ω, r_{12} = 800Ω, r_{21}= 1.98MΩ and r_{22} = 2 MΩ is used in a single –stage, common-emitter amplifier, with a load resistance of 430Ω. Calculate;

i. The voltage gain
ii. The current gain
iii. The input resistance

b.

i. List the difference(s) between fixed negative voltage regulator and adjustable voltage regulator. Give one of each.

ii. The output voltage of a three-terminal voltage regulator is 5 V @ 5 mA load, and 4.96 V @ 1.5 A load. What is the regulator's load regulation?

c. Classify the following filter as active/passive and lowpass/high-pass, etc

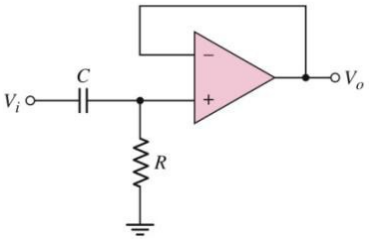


Fig 1

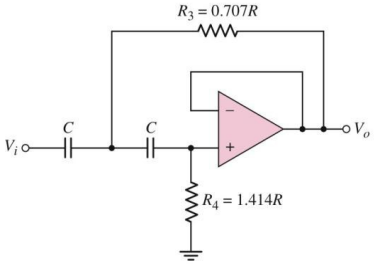


Fig 2

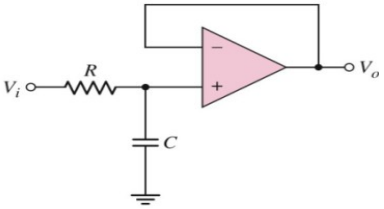


Fig 3

QUESTION TWO

a.

The hybrid parameters of a certain transistor are:h_{11}= 35Ω , h_{21}= -0.976, h_{22} = 1.0 μS, h_{12}= 7 x 10 $^{-4}$.

Calculate the values of

i. r_{11}
ii. r_{12}
iii. r_{21}
iv. r_{22}
v.
vi. r_e
vii. r_b
viii. r_c

b.

i. State three uses of multivibrator.

ii. An engineer designs a class-AB amplifier to deliver 2 W (sinusoidal) signal power to an 8Ωresistive load. Ignoring saturation in the output BJTs, what is the required peak-to-peak voltage swing across the load?

c.

i. Define the following Mark-to-Space Ratio (MSR), Pulse Repetition Time (PRT), and Pulse Repetition Frequency (PRF).

ii. Estimate the voltage gain of the the amplifier in Fig 4.

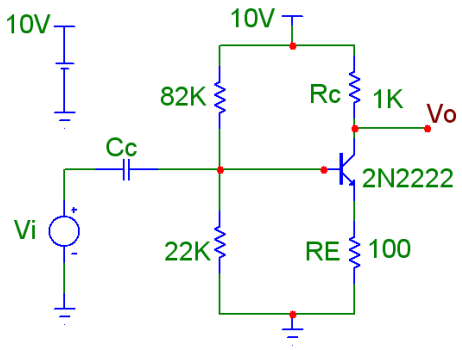


Fig 4

QUESTION THREE

a.

i. What is common-mode rejection ratio (CMRR) ?

ii. With inputs V_{i1} = -50mV, and V_{i2} = +50mV, a difference amplifier has output V_O. With inputs, V_{i1} = V_{i2} = 5V, the output is V_O = 0.4153 V. Determine the CMRR, expressed in dB.

b. Consider the circuit below (Fig 5), if the maximum power the transistor dissipated is P_{Qmax} = 25 W determine

i. R_L such that maximum power is delivered to the load.

ii. The average power dissipated in the transistor given that Vp = 12mV.

c. Consider the amplifier below (Fig 6). A dc analysis shows that I_1= 1.94mA ≈I_{c5} and I_{c3} = 1.07 mA. Determine the voltage gain = Vo/V_1-V_2.β = 200

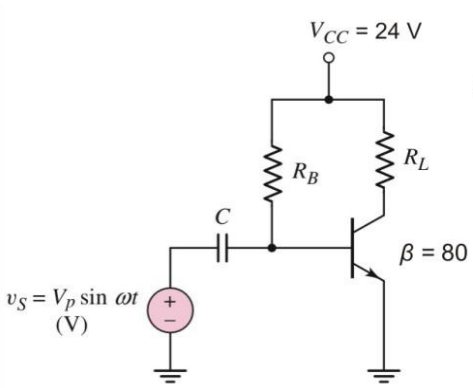


Fig 5

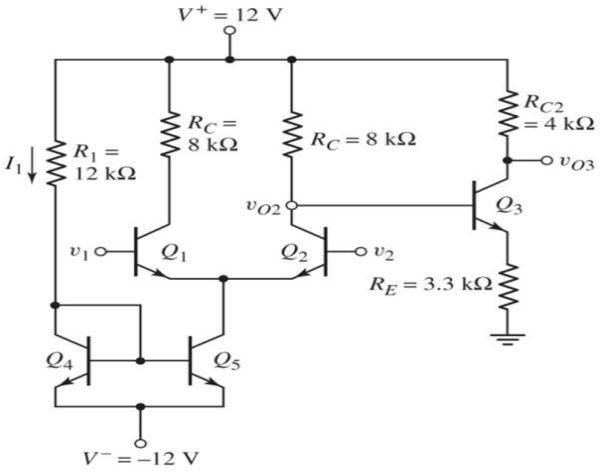


Fig 6

QUESTION FOUR

a. For the switched-capacitor circuit below, the parameters are C_1= 30pF, C_2 = 5 pf, C_F= 12pF . The clock frequency is 100 kHz. Determine the low-frequency gain and

the cutoff frequency.

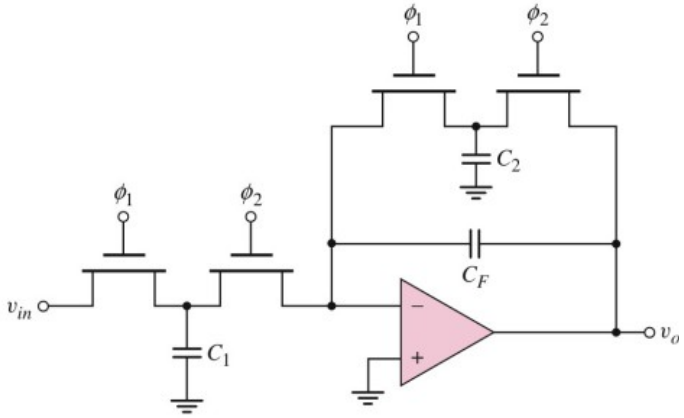


Fig 7

b.

i. Draw a diagram to represent a complete solid state power supply .

ii. In the half-wave rectifier circuit of Fig. 8, determine

1. Maximum and values of load voltage
2. Peak and values of load current
3. Power absorbed by the load,
4. PIV of the diode
5. rms value of ripple voltage

Neglect resistance of transformer secondary and that of the diode.

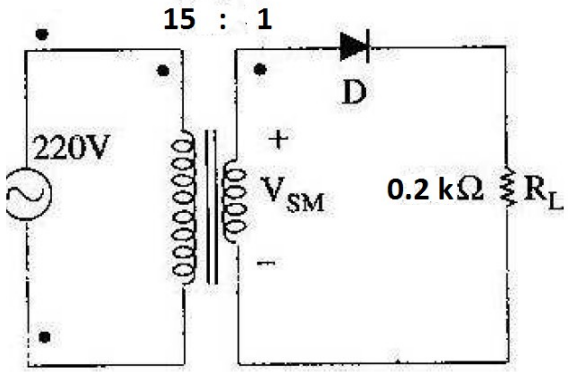
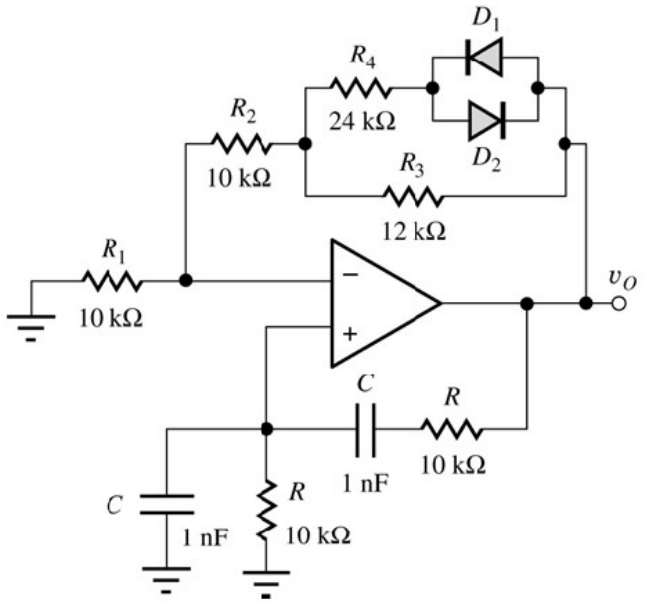


Fig. 8

c. Explain in details the term piezoelectric effect.

QUESTION FIVE

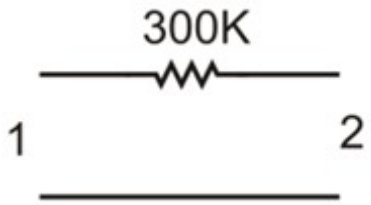
a. Consider the circuit below. Determine the voltage at which the output stabilizes



b.

i. For the following circuit, what is the numerical value for the two-port *y*-parameter

$$y_{12}.y_{12}=\frac{i_1}{v_2}|v_1=0$$



c. An amplifier with gain of 200 has a 10% variation in gain over a certain frequency range. Using negative feedback, what value of βshould one use to reduce the gain variation to 1%?

d. An amplifier with negative feedback has an open-loop gain of . If open-loop gain increases by what is the percentage change in the closed-loop gain?

QUESTION SIX

a.

i. What is an op-amp?

ii. State three uses of op-amp

iii. The input to the differentiator circuit of the fig 11 is a sinusoidal voltage of peak value of 5 mV and frequency 1 kHz. Find out the output if R = 1000kΩ and C = 1μF.

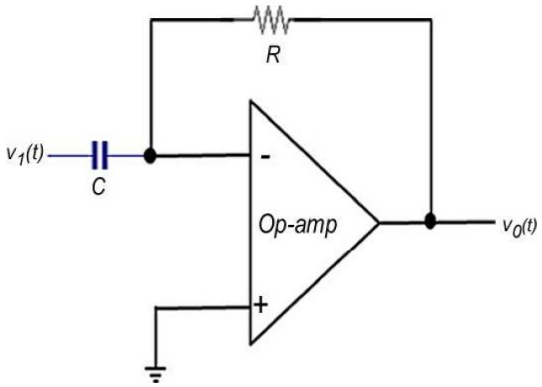
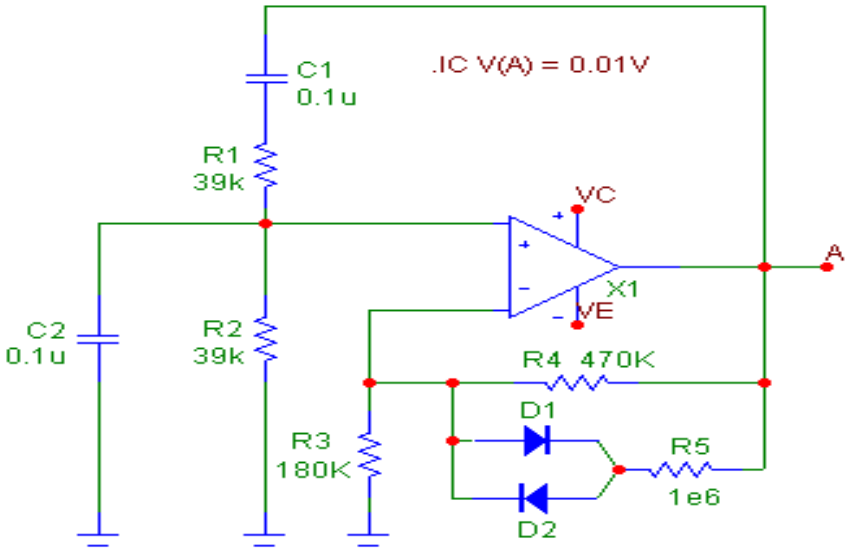


Fig. 11

b. A technician wants to reduce the output amplitude of the Wien bridge oscillator below by adjusting R_5 . Should she increase or decrease the resistor's value? Briefly explain you answer

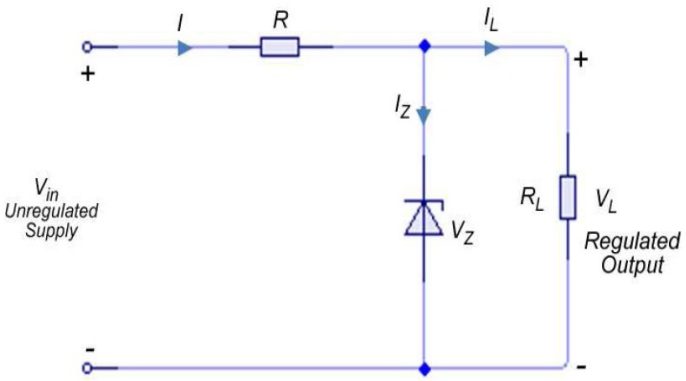


c. Draw the block diagram of a voltage divider.

QUESTION SEVEN

a. The Zener diode of Fig. has the following ratings:

$V_{Z=}$ 6.8 V , I_Z = 50 mA@ r_z= 2Ω. $I_{Z(min)}$ = 5mA , $I_{Z\,(max)}$ = 150mA



What would be the load voltage when load current I_L varies from 10 mA to 120 mA? Also, calculate voltage regulation of the regulator.

b.

i. State advantages and disadvantage of class A amplifier.

ii. For a Class B amplifier providing a 20 V peak signal to a 16Ω(speaker) and a power supply of V_{CC} = 30 V , determine the input power, outputpower and circuit efficiency.

c. An single-pole op-amp has an open-loop low-frequency gain of A = 10^5 and an open loop, 3-dB frequency of 4 Hz. If an inverting amplifier with closed-loop low-frequency gain of $|A_f|$ uses this op-amp, determine the closed-loop bandwidth.