

Chapter-5(Pulse generator Circuit)

Q.1. Anamika discovered that the following block diagram was utilized to obtain the pulse amplitude modulation signal while studying the PAM modulator in her data communication class.

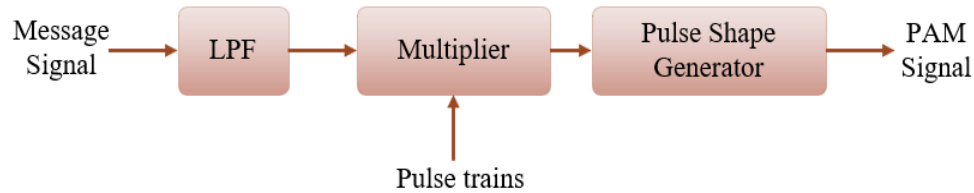
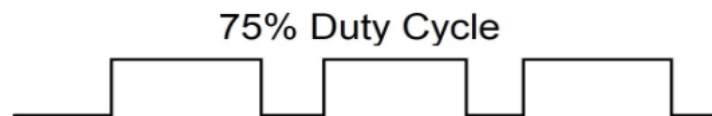


Fig. 1. Block diagram of PAM modulator

This procedure involves the LPF converting the message signal into a band-limited signal, which is then sampled by the multiplier. The Multiplier obtains samples through the utilization of pulses train. Finally, the multiplication of the message signal and pulse train produces PAM. **How** can you generate these pulses of a train from two analog input signals? Explain with the necessary circuit diagram.

Q.2. Determine the on time and off time of the following figure. Consider frequency is 5000Hz.



Chapter-1: Induction Motor

Q.1. Suppose you are working on the speed control of the induction motor in the machine lab. you are using a voltage control method for controlling the speed. But when you supply low voltage, it generates a huge amount of heat in the motor. Explain the reasons behind it.

Q.2. Why does an induction motor is called a rotating transformer?

Q.3. What is a slip? Prove that due to inductive load, the total torque of an induction motor is zero.

Q.4. What are the differences between synchronous motors and alternators?

Q.5. Why does a synchronous motor rotate at a constant speed?

Q.6. Why does single phase induction motor not call self-starting motor? How can you make them self-starting.

Q.7. A 3-phase, star-connected 400 V, 50-Hz, 4-pole induction motor has the following per-phase parameters in ohms, referred to as the stators.

$R_1=0.15$, $X_1=0.45$, $R_2=0.12$, $X_2=0.45$, $X_m=28.5$

Compute the stator current and power factor when the motor is operated at rated voltage and frequency with $s=0.04$.

Q.8.

A 3-phase, 3% slip, induction motor is driven by an alternator which is shown in the following figure. Calculate the full load speed of the motor.

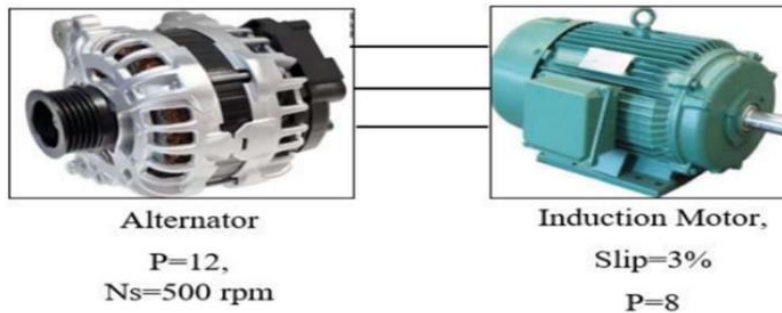


Figure 3. Induction motor is driven by the alternator

Chapter-2: Optoelectronics Transducer

Q.1. What is a self-transducer? How does a photo-emissive cell convert light energy into electrical energy? Explain with a proper circuit diagram.

Q.2. Tanha, a student of CSE, wants to find out the characteristics of phototransistors. For this purpose, she takes five illumination levels and lists the data below:

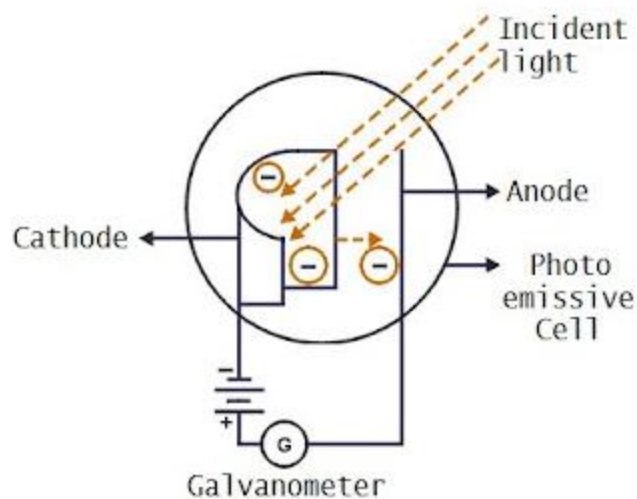
<i>Illumination Level</i> <i>(w/m²)</i>	<i>Output Voltage (Volt.)</i>	<i>Collector Current (mA)</i>
0	20	0
100	17	0.75
200	14	1.5
300	7.1	3.225
400	4.9	3.775

(a) Could you explain why the output voltage decreases with increasing illumination power of light in a photo-transistor?

(b) What is the value of voltage drop across a $4k\Omega$ resistor?

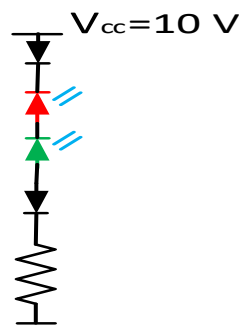
Q.3. How does photovoltaic cell generate electricity?

Q.4. The apparatus shown below was set up to investigate the photoelectric effect.



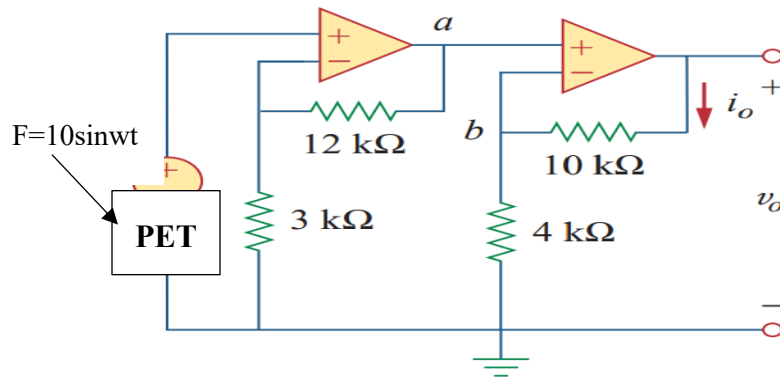
Using this apparatus, it is found that light of wavelength 254 nm ($2.54 \times 10^{-7}\text{m}$) ejects photoelectrons from a silver plate. The work function of the silver surface is 4.7 eV. What is the kinetic energy, in eV, of the fastest moving photoelectrons ejected by light of 254 nm?

Q.5. Calculate the current through a 10 ohms resistor as shown in the following figure. Assume that, the voltages across the black diode, red diode, and green diode are 0.7 V, 2V, and 3V respectively.

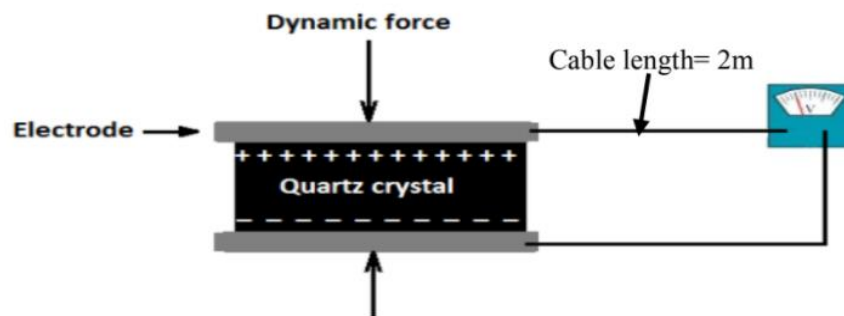


Chapter-3: Piezoelectric Transducer

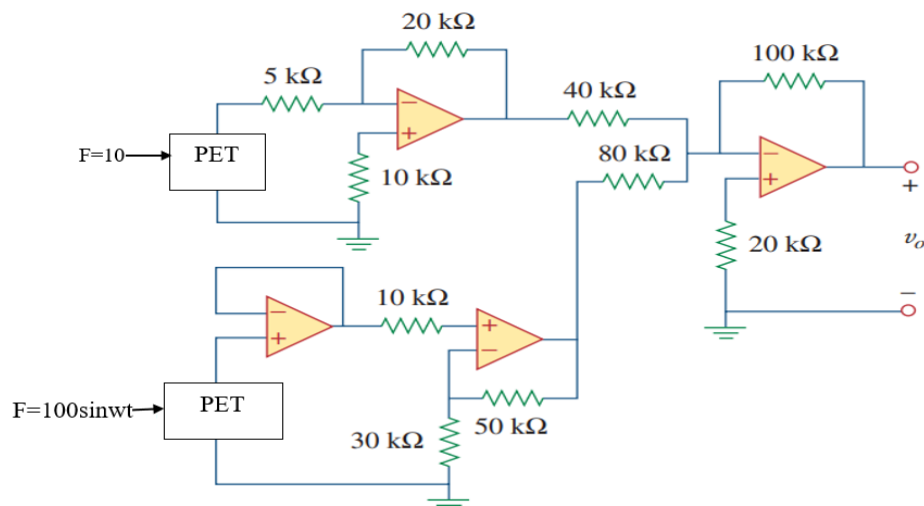
Q.1. Sumaya, a student of CSE, is building her own battery charger. For this, she has set up an arrangement like Figure 3. By using this arrangement, can she make a 5 V battery charger? Show proper logic in support of your answer. [area= 10m^2 , thickness 10 mm]



Q.2. A PET is directly connected to a voltmeter via a cable, shown in the following figure. The minimum operating frequency of this measurement is 1000 Hz. Determine the cable length if the operating frequency is 1500 Hz.



3. Sumaya, the student of CSE, is building her own battery charger. For this, she has set up an arrangement like figure 3. By using this arrangement, can she make a 5 V battery charger? Show proper logic in support of your answer. [area= 10 m^2 , thickness 10 nm]



Q.4. Mr. X and Mr. Y are two friends. One day they were walking on the street and saw that a man in a strange dress has shown many magical activities. He introduced a crystal that turned on the

LED light by giving pressure on it. Everyone was surprised by those activities. But Mr. Y said that this crystal is a piezoelectric transducer and is also known as a self-transducer. It can't generate high voltage. For increasing voltage level extra devices are needed. justify the statement of Mr. Y.

Q.5. What do you mean by piezoelectric effect? Why does piezoelectric transducer need amplifier device?

Q.6. What are the advantages and disadvantages of piezoelectric transducer?

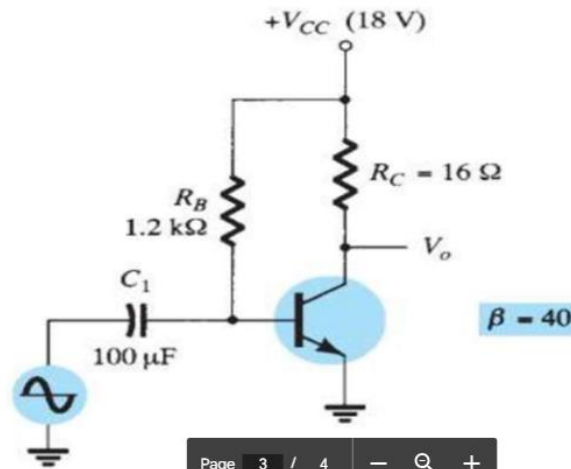
Q.7. Discuss the operating principle of piezoelectric transducer?

Q.8. Prove that the generated voltage across a piezoelectric transducer is directly proportional to applied pressure.

Chapter-6_ Power Amplifier

Q.1.

Sumaiya, a student of the CSE department, has developed a class A amplifier in her laboratory. The circuit diagram of her designed topology has been presented in Figure 5. She expects she will get 50% efficiency from this circuit. Do you agree with Sumaiya? Justify your answer with mathematical verification. Assume that, the input signal results in a base current of 5 mA rms.



Q.2. The output response of the class B amplifier circuit is being analyzed in the laboratory. It has been observed that there is a lack of response in the output voltage during a specific period, which is approximately the transition region. What do you believe is causing the problem? How can this issue be resolved?

- (b) If the input voltage to the power amplifier of figure 2 is 8 V(rms). Calculate: (i) [CO3] output power (ii) efficiency.

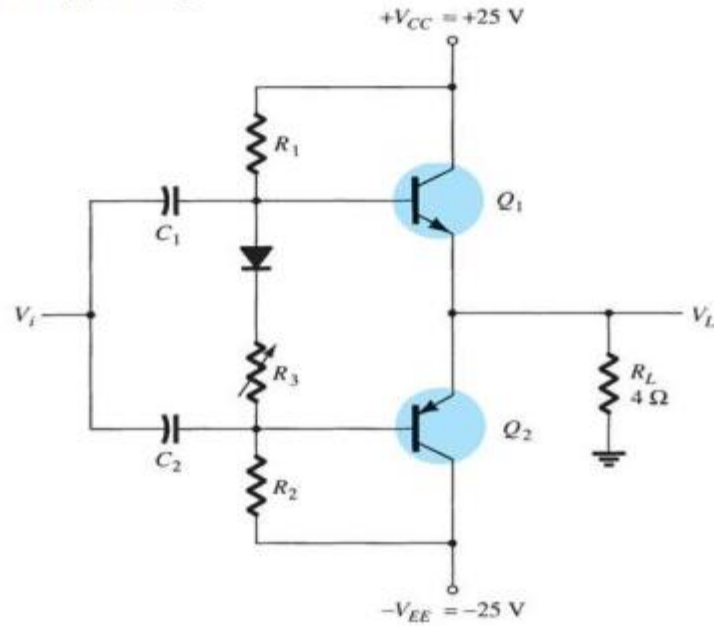
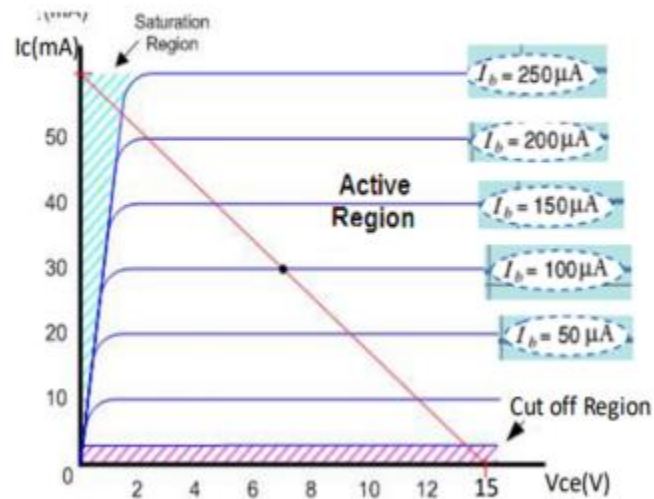


Fig. 2

Q.3.

- (c) You are Mr. X, an assistant engineer of EGCB, who is working with a power amplifier. You have got the following output response in the datasheet of the required amplifier. How will you have designed such an amplifier? [CO3]

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Q.1. What is transducer. Explain the operating principle of transducer.

Q.2. What are the difference between active and passive transducer?

Q.3. What is LVDT? Why is it called secondary transducer?

Q.4. Suppose, Mahmudur transmits information to his friend Rabeya through an analog platform. Unfortunately, Rabeya has received false information. What do you think, what is the reason behind it? How can you solve this problem?

magnetic tape recorders

Describe the method of pulse duration modulation (PDM) as used in magnetic tape recorders. If the gap of this tap-recorder is $6.25 \mu\text{m}$. Determine the speed of the tap-recorder so to have a satisfactory response at 50 kHz. Assume that recorded wavelength must be greater than 2.5times the gap of the recorder.