SYLLABUS

ELECTRONIC DEVICES AND CIRCUITS **3 0 0 3**

1. PN DIODE AND ITS APPLICATIONS **9**

PH junction diode-VI characteristics – Rd, temperature effects – Drift ad diffusion currents – switching – Rectifiers: HWR, FWR, BR, filters-Zener diode – VI characteristics, Regulators (series and shunt), LED, LCD characteristics and applications.

2. BJT AND ITS APPLICATIONS **9**

Junction transistor – Transistor construction – Input and output characteristics – CE, CB and CC configurations – hybrid model – Analytical expressions – switching – RF application – Power transistors – Opto couplers.

3. FET AND ITS APPLICATIONS **9**

FET – VI characteristics, VP, JFET – small signal model – LF and HF equivalent circuits – CS and CD amplifiers –cascade and cascade – Darlington connection – MOSFET – Characteristics – enhancement and depletion

4. AMPLIFIERS AND OSCILLATORS **9**

Differential amplifiers: CM and DM – condition for ofc-feedback amplifiers – stability – Voltage / current, series / shunt feedback – oscillators – LC, RC, crystal

5. PULSE CIRCUITS **9**

RC wave shaping circuits – Diode clampers and clippers – Multivibrators – Schmitt triggers – UJT based saw tooth oscillators.

TOTAL : 45 PERIODS

TEXT BOOK

1.Paynter, “Introductory lectronic devices and circuits, 2006, PHI
2.David Bell “Electronic Devices and Circuits” 2007, PHI

REFERENCES

1.Theodre F.Boghert, “Electronic Devices & Circuits” Pearson Education, VI Edition, 2003
2. Rashid, “Microelectronic circuits” Thomson Publication, 1999
3. B.P.Singh & Rekha Sing, “Electronic Devices and Integrated Circuits” Pearson Education, 2006.

UNIT-I - PN DIODE AND ITS APPLICATIONS

1. What is depletion region in PN junction?

The region around the junction from which the mobile charge carriers (electrons and holes) are depleted is called as depletion region. Since this region has immobile ions, which are electrically charged, the depletion region is also known as space charge region.

2. Give the other names of depletion region?

i. space charge region
ii. Transition region

3. What is barrier potential?

The oppositely charged ions present on both sides of PN junction an electric potential is established across the junction even without any external voltage source which is termed as barrier potential.

4. What is meant by biasing a PN junction?

Connecting a PN junction to an external voltage source is biasing a PN junction.

5. What are the types of biasing a PN junction?

1. Forward bias 2. Reverse bias.

6. What is forward bias and reverse bias in a PN junction?

When positive terminal of the external supply is connected to P region and negative terminal to N region, the PN junction is said to be forward biased. Under forward biased condition the PN region offers a very low resistance and a large amount of current flows through it.

7. What is reverse bias in a PN junction?

When positive terminal of the external supply is connected to N type and negative terminal to P type then the PN junction is said to be in reverse bias. Under reverse biased condition the PN region offers a very high resistance and a small amount of current flows through it.

8. What is Reverse saturation current?

The current due to the minority carriers in reverse bias is said to be reverse saturation current. This current is independent of the value of the reverse bias voltage.

9. Why contact differences of potential exist in PN junction?

When a PN junction is formed by placing a p-type and n-type material in intimate contact, the Fermi level throughout the newly formed specimen is not constant at equilibrium. There will be transfer of electron and energy until Fermi levels in the two sides did line up. But the valence and conduction band in p side cannot be at the same level as in n side .this shift in energy level results in contact difference of potential.

10. What is the static resistance of a diode?

Static resistance R of a diode can be defined as the ratio of voltage V across the diode to the current flowing through the diode.

$R = V/ I$

Where

R - Static resistance of a diode

V - Voltage across the diode

I - current across the diode

11. Define dynamic resistance.

Dynamic resistance of a diode can be defined as the ratio of change in voltage across the diode to the change in current through the diode.

$r = V / I$

Where

r - Dynamic resistance of a diode

V - change in voltage across the diode

I - change in current through the diode

12. What is an amplifier?

An amplifier is a device which produces a large electrical output of similar Characteristics to that of the input parameters.

13. Why do we choose q point at the center of the load line?

The operating point of a transistor is kept fixed usually at the center of the active region in order that the input signal is well amplified. If the point is fixed in the saturation region or the cut off region the positive and negative half cycle gets clipped off respectively.

14. When does a transistor act as a switch?

The transistor acts as a switch when it is operated at either cutoff region or saturation region.

15. What is biasing?

To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the transistor. This is called biasing.

16. What is operating point?

For the proper operation of the transistor a fixed level of current and voltages are required. This values of currents and voltages defined at a point at which the transistor operate is called operating point.

12. **Define luminescence**

Light can be emitted by a solid when it is stimulated by the source of incident energy. This phenomenon is called luminescence

13. **What are the types of luminescence?**

a) Photoluminescence b) Electroluminescence

14. **Define photoluminescence**

It is incident energy is in the form of photons, then it is called photoluminescence

15. **Define electroluminescence**

If the radiation is produced by the application of an electric field, it is termed as electroluminescence

16. **Which colour of light is emitted by GaAs, Gp, GaAsp**

GaAs - Infra red radiation (invisible) GaP - Red or Green
GaAsP - Red or Yellow

17. **Define injection laser diode**

When the emitted light is coherent, (ie) essentially monochromatic, then such a diode is referred to as an injection laser diode

18. **What are the limitations of LCD?**

* It requires an external or internal light source
* Temperature range is limited to about 60oC
* Lime time is limited due to chemical degeneration

19. **What are the two types of LCDs?**

a) Dynamic scattering type LCD b) Field effect LCD

20. **Name the crystal materials used to LCD?**

a) Nematic b) Cholesteric

PART-B

1. Explain forward bias and reverse bias in a PN junction and also VI characteristics of PN junction.

2. Explain the VI characteristics of zener diode.

3. Explain the characteristics of LED and LCD.

4. How does the zener diode act as a voltage regulator? Explain.

5. Explain the hall wave and full wave rectifiers with relevant diagram.

UNIT – II - BJT AND ITS APPLICATIONS

1. **Define Transistor**

Transistor consists of two junctions formed by sandwiching either P-type or N-type semiconductor between a pair of opposite types.

2. Write the current amplification factor for a CB transistor.

a = Change in Collector Current at constant V_{CB} / Change in emitter current

3. Write the formula for input resistance in a CB transistor

Input resistance = Change in base - emitter voltage / Change in emitter current at constant V_{CB}

4. Write the current amplification factor for a CE transistor.

b = Change in Collector Current / Change in base current at constant V_{CE}

5 . Define transistor action.

A transistor consists of 2 coupled PN junctions. The base is a common region to both junctions and makes a coupling between them. Since the base regions are smaller, a significant interaction between junctions will be available. This is called transistor actions.

6. Define delay time

It is defined as the time required for the current to rise from 0 to 10% of its maximum value.

7. Define rise time

It is the time required for the current to rise from 0 to 90 percentage of the maximum value.

8. Define turn-on time

It is the time required for the current to rise from 0 to 90 percentage of the maximum value $t_{on} = t_d + t_r$

9. Define fall time

It is the time required for the Collector current to fall from 90 to 10 percentages of I_{cs}.

10. Define Storage time

It is the time required to fall from 100 to 90 percent of I_{cs}.

11. Define turn-off time

It is the time required to fall from 100 to 90 percent of I_{cs}. $T_{off}=t_s+t_r$

12.Define hybrid parameters.

Any linear circuit having input and output terminals can be analysed by four parameters(one measured on ohm, one in mho and two dimensionless) called hybrid or h-parameters.

13. What are the use of h - Parameters?

It perfectly isolates the input and output circuits. Its source and load currents are taken into account.

14. . Define power transistors

Power transistors are those which handle a large amount of current and also dissipates large amount of power across collector base junction.

15. Define current amplification factor in CC transistor.

g =Change in emitter current /Change in base current at constant V_{CE}

16. Which is the most commonly used transistor configuration?Why?

The CE Configuration is most commonly used.

The reasons are

* High Current gain
* High voltage gain
* High power
* Moderate input to output ratio.

17. What are the values of input resistance in CB, CE & CC Configuration

CB - Low about 75 CE - Medium About 750 CC - Very high about 750.

18. Write the voltage and current equation for hybrid parameters.

$V_1 = h_{11}i_1 + h_{12}V_2$ $i_2 = h_{21}i_1 + h_{22}V_2$

19. What are the values of h-parameters?

$h_{11} = V_1/ i1$; $h_{12} = V_1 / v_2$; $h_{21} = i_2 / i_1$; $h_{22} = i_2 / v_2$

20. h – parameter is applied to linear circuit : True or False.

True

PART-B

1. a). Explain the operation of PNP & NPN transistor? (12)

   b). What is transistor? State its types (4)

2. a). Explain the current components of a transistor? (8)

   b). Explain the transistor switching time? (8)

3. a). Explain Ebers – Moll model . (8)

   b). Compare CE – CB – CC Configuration? (8)

4. a). Explain the input & output characteristics of CE configuration of a transistor? (12)

   b). State FET& its types? (4)

5. a)Explain the input & output Characteristic of CB configuration of a transistor? (12)

   b) State about the VMOS Devies?

UNIT - III - FET AND ITS APPLICATIONS

1. What are the advantages of FET

* Input impedance is very high. This allow high degree of Isolation between the input & output Circuit.
*Current carriers are not crossing the junctions hence noise is highly reduced.
* It has a negative temperature Co-efficient of resistance. This avoids the thermal runaway.

2. What are the advantages of MOSFET compared to JFET?

The input impedance of MOSFET is higher than that of JFET

3. What are the two modes of MOSFET?

(a) Depletion mode (b) Enhancement mode

4. Why UJT is called so?

UJT has only one PN junction so it is called as uni junction transistor

5. What are the advantages of SCR and TRIAC?

SCR performs rectification, inversion and regulation of power flow
TRIAC is a bidirectional switch and hence it can conduct in both the direction.

6. Define breakdown voltage

The applied voltage at which the thyristors conducts heavily without gate voltage.

7. Define latching current

It is the minimum current required to latch the device from OFF to ON state

8. Define holding current

It is defined as the minimum current required to hold the device into conduction.

9. Define turn - on time

It is the time taken by the SCR to reach to its full conduction from the time the trigger is applied.

10. Define turn - off time

It is the finite time taken by the SCR after application of the reverse voltage to switch the device off.

11. What are the advantage of SCR?

Switching speed is high No moving parts. So it gives noiseless operation at high frequency It controls large current in the load by means of small gate current Occupies less space

12. Give some applications of thyristor?

Used for power control Used for speed control of a d.c shunt motor

13. Define finger voltage

It is defined as the minimum voltage which is required between anode and the cathode of thyristor to trigger into conduction

14. What is the name for solid state equivalent of thyristor

Thyratron.

15. Define inter-base resistance

It is the resistnce offered by the silicon bar

16. Define pinch-off voltage

It is the drain source voltge above which the drain current becomes constant

17. What are the differences between JFET & BJT

S.NO	JFET	BJT
1.	Unipolar device	Bipolar device
2.	High input impedance	Low input impedance due to forward bias
3.	Voltage driven device	Current driven device
4.	Gain is characterized by transconductance gain	Gain is characterized by voltge
5.	Low noise level	High noise level

18. What is amplification factor

It is the product of drain résistance and transconductance m=Rd x gm Rd=Drain

resistance, gm=Transconductance

19. Define drain resistance

It is the ratio of change in drain source voltage to change in drain current at constant gate source voltage.

20. What is Reverse saturation current?

The current due to the minority carriers in reverse bias is said to be reverse saturation current. This current is independent of the value of the reverse bias voltage.

PART-B

1. Compare the following

a) D MOSFET & EMOSFET

b) n-channel MOSFET & p –channel MOSFET. **(16)**

2. a). What are the applications of JFET? Explain JFET as VVR**. (8)**

b). Explain the biasing technique for enhancement MOSFET? **(8)**

3. Prove that the voltage divider biasing provide better stability than other techniques? **(16)**

UNIT – IV - AMPLIFIERS AND OSCILLATORS

1. What is an amplifier?

An amplifier is a device which produces a large electrical output of similar Characteristics to that of the input parameters.

2. Why do we choose q point at the center of the load line?

The operating point of a transistor is kept fixed usually at the center of the active regionin order that the input signal is well amplified. If the point is fixed in the saturation region or the cut off region the positive and negative half cycle gets clipped off respectively.

3. When does a transistor act as a switch?

The transistor acts as a switch when it is operated at either cutoff region or saturation region.

4. What is biasing?

To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the transistor. This is called biasing.

5. What is operating point?

For the proper operation of the transistor a fixed level of current and voltages are required. This values of currents and voltages defined at a point at which the transistor operate is called operating point.

6. What is d.c load line?

The d.c load line is defined as a line on the output characteristics of the transistor which gives the value of I_c & V_{CE} corresponding to zero signal condition.

7. What is the necessary of the coupling capacitor?

It is used to block the DC signal to the transistor amplifier. It allows a c & blocks the d c

.

8. Why is the operating point selected at the Centre of the active region?

The operating point is selected at the Centre of the active region to get to perfect amplification. Moreover there is no distortion.

9. Define an operational amplifier.

An operational amplifier is a direct-coupled, high gain amplifier consisting of one or more differential amplifier. By properly selecting the external components, it can be used to perform a variety of mathematical operations.**10. Mention the characteristics of an ideal op-amp.**

* Open loop voltage gain is infinity.
* Input impedance is infinity.
* Output impedance is zero.
* Bandwidth is infinity.
* Zero offset.

11. What happens when the common terminal of V+ and V- sources is not grounded?

If the common point of the two supplies is not grounded, twice the supply voltage will get applied and it may damage the op-amp.

12. Define input offset voltage.

A small voltage applied to the input terminals to make the output voltage as zero when the two input terminals are grounded is called input offset voltage

13. Define input offset current. State the reasons for the offset currents at the input of the op-amp.

The difference between the bias currents at the input terminals of the op-amp is called as input offset current. The input terminals conduct a small value of dc current to bias the input transistors .Since the input transistors cannot be made identical, there exists a difference in bias currents.

14. Define CMRR of an op-amp.

The relative sensitivity of an op-amp to a difference signal as compared to a common – mode signal is called the common –mode rejection ratio. It is expressed in decibels.

CMRR= Ad/Ac

15. In practical op-amps, what is the effect of high frequency on its performance?

The open-loop gain of op-amp decreases at higher frequencies due to the presence of parasitic capacitance. The closed-loop gain increases at higher frequencies and leads to

Instability

16. Define slew rate.

The slew rate is defined as the maximum rate of change of output voltage caused by a step input voltage. An ideal slew rate is infinite which means that op-amp's output voltage should change instantaneously in response to input step voltage.

17. Mention any two audio frequency oscillators:

- RC phase shift oscillator
- Wein bridge oscillator

18. Mention some of the linear applications of op – amps:

Adder, subtractor, voltage –to- current converter, current –to- voltage converters, instrumentation amplifier, analog computation, power amplifier, etc are some of the linear op-amp circuits.

19. Mention some of the non – linear applications of op-amps:-

Rectifier, peak detector, clipper, clamper, sample and hold circuit, log amplifier, anti –log amplifier, multiplier are some of the non – linear op-amp circuits.

20. What are the areas of application of non-linear op- amp circuits?

- .Industrial instrumentation
- Communication
- Signal processing

PART-B

1. Explain the working principle of operational amplifier.
2. Explain the working principle of oscillators
3. Explain the types of feedback amplifiers
4. Explain the types of differential amplifiers.

UNIT – V - PULSE CIRCUITS

1. What is a multivibrator?

Multivibrators are a group of regenerative circuits that are used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square output. It has two states stable or quasi- stable depending on the type of multivibrator.

2. What do you mean by monostable multivibrator?

Monostable multivibrator is one which generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state. Application of a trigger causes a change to the quasi-stable state. An external trigger signal generated due to charging and discharging of the capacitor produces the transition to the original stable state.

3. What is an astable multivibrator?

Astable multivibrator is a free running oscillator having two quasi-stable states. Thus, there is an oscillation between these two states and no external signal is required to produce the change in state.

4. What is a bistable multivibrator?

Bistable multivibrator is one that maintains a given output voltage level unless an external trigger is applied. Application of an external trigger signal causes a change of state, and this output level is maintained indefinitely until a second trigger is applied. Thus, it requires two external triggers before it returns to its initial state.

5. What are the requirements for producing sustained oscillations in feedback Circuits?

For sustained oscillations, the total phase shift around the loop must be zero at the desired frequency of oscillation. At desired frequency, the magnitude of the loop gain | A b | should be equal to unity

6. Mention any two audio frequency oscillators:

- RC phase shift oscillator
- Wein bridge oscillator

7. What is a filter?

Filter is a frequency selective circuit that passes signal of specified band of frequencies and attenuates the signals of frequencies outside the band

8. What are the demerits of passive filters?

Passive filters works well for high frequencies. But at audio frequencies, the inductors become problematic, as they become large, heavy and expensive. For low frequency applications, more number of turns of wire must be used which in turn adds to the series resistance degrading inductor's performance ie, low Q, resulting in high power dissipation.

9. What are the advantages of active filters?

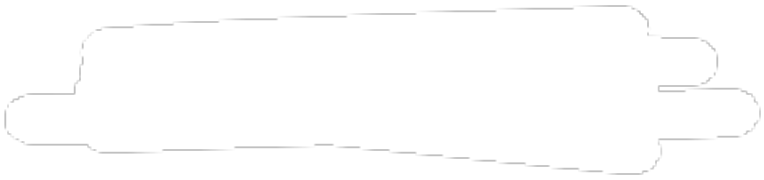
Active filters used op- amp as the active element and resistors and capacitors as passive elements. By enclosing a capacitor in the feed back loop , inductor less active filters can be obtained.Op-amp used in non – inverting configuration offers high input impedance and low output impedance, thus improving the load drive capacity.

10. Mention some commonly used active filters:

- Low pass filter
- High pass filter
- Band pass filter
- Band reject filter.

11. Mention some applications of 555 timer:

- Oscillator
- Pulse generator
- Ramp and square wave generator
- Mono-shot multivibrator
- Burglar alarm



• Traffic light control.

12. List the applications of 555 timers in monostable mode of operation:

• Missing pulse detector
• Linear ramp generator
• Frequency divider
• Pulse width modulation.

13. List the applications of 555 timers in Astable mode of operation:

• FSK generator
• Pulse-position modulator

14. Define combinational logic

When logic gates are connected together to produce a specified output for certain specified combinations of input variables, with no storage involved, the resulting circuit is called combinational logic.

15. Explain the design procedure for combinational circuits

• The problem definition
• Determine the number of available input variables & required O/P variables.
• Assigning letter symbols to I/O variables
• Obtain simplified Boolean expression for each O/P.

16. Define half adder and full adder

The logic circuit that performs the addition of two bits is a half adder. The circuit that performs the addition of three bits is a full adder.

17. Define Decoder?

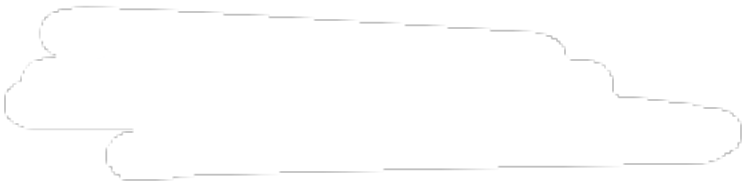
A decoder is a multiple - input multiple output logic circuits that converts coded inputs into coded outputs where the input and output codes are different.

18. What is binary decoder?

A decoder is a combinational circuit that converts binary information from n input lines to a maximum of 2n out puts lines.

19. Define Encoder?

An encoder has 2n input lines and n output lines. In encoder the output lines generate the binary code corresponding to the input value.



20. What is priority Encoder?

A priority encoder is an encoder circuit that includes the priority function. In priority encoder, if 2 or more inputs are equal to 1 at the same time, the input having the highest priority will take precedence.

PART-B

1. Explain the RC wave shaping circuits
2. Explain the Diode clampers
3. Explain the working of clippers
4. Explain the types of each Multivibrators
5. Explain the Schmitt triggers.