Q.2a. What is epitaxial layer? Describe one way which it can be created.

Ans. Text book –II, Article 1.5.2

b.Describe the methods used to fabricate capacitors in monolithic integrated circuits.

Ans. Text book –II, Article 1.4.4

c.It is desired to fabricate a 1.5 kΩ resistors using a diffused P Layer having sheet resistance 200Ω/squares. (4)

(i) What aspect ratio should the resistor have?

(ii) What should be the total length of the diffused region?

c)

Resistance R= (ρ/t)(t/W)= Rsxa

Where ρ is the resistivity

So a= R/Rs= 1500/200=7.5

Aspect ratio= a

a = l/W=7.5

l= 7.5 W =7.5(30 micron) =225 micron=0.225mm

.3 a. In an NPN silicon transistor α = 0.995, I_E = 10mA, leakage current I_{CBO} = 0.5μA. Determine I_C, I_B, β, I_{CEO}

Q 3 a)

i) $I_C = \alpha I_E + I_{CBO}$

$= 0,995 \times 10mA + 0.5\mu A$

$= 9.9505$ mA

$I_B = I_E - I_C$

$=10-9.9505= 49.5\ \mu A$

$\beta= \alpha/1-\alpha\ = .995/1-.995$

$= 199$

$I_C= \beta I_B + I_{CEO}$

$I_{CEO} = 9.9505-199x.0495\ =100\ \mu A$

b. Draw an h-parameter equivalent circuit for the CE circuit with voltage divider bias, a bypassed emitter resistor, a capacitor coupled signal source and capacitor coupled load. Briefly explain.

Ans. Text book –I , Article 6.4

Q.4a. Explain the operating Principle of N channel JFET.

Ans. Text book –I , Article 9.1

b.Explain how an FET can be used as an Amplifier?

Ans. Text book –I , Article 9.4

c.An N channel JFET has a pinch-off voltage of –4.5 V and I_{DSS} = 9mA **(8)**

(i) At what value of V_{GS} in the pinch-off region will I_D = 3mA
(ii) What is the value of $V_{DS(sat)}$ when I_D = 3mA

c)i) $I_D = I_{DSS}(1 - V_{GS}/V_P)^2$

$V_{GS} = V_P(1 - \sqrt{I_D / I_{DSS}})$

$= -1.9V$

ii) $I_D = I_{DSS}(V_{DS(sat)}/V_P)^2$

$= V_{DS(sat)} = \sqrt{(V_P)^2 I_D / I_{DSS}}$

$= (4.5)^2(3\ mA)/(9mA) = 2.6V$

Q.5 a. Explain how LED different from an ordinary pn junction diode? Describe its construction in brief.

Ans. Text book –I , Article 20.2

b.Two amplifier stages are required to be coupled by a coupling transformer, if the output impedance of first stage is 12 kΩ while the input impedance of the second stage is 3 kΩ. What should be the inductance of primary and secondary of the transformer so that prefect matching be obtained at a frequency of 250 Hz.

b) b) Operating frequency= f 250 Hz

output impedance of first stage= 12kΩ

input impedance of second stage= 3kΩ

Let the inductance of primary winding =Lp

Primary impedance =2 πfLp

For perfect impedance matching= 12000=2 πfLp

Lp= 7.64H

Let the inductance of secondary winding= Ls

Secondary inductance=2πfLs

For perfect impedance matching=

3000=2πfLs

Ls= 1.91H

2x4 =8 marks

Q.6 a. What are the characteristics of ideal OPAMP?

Ans. Text book –II , Article 2.3

b.Define the following parameters: **(4)**

(i) Input bias current
(ii) CMMR
(iii) Slew Rate
(iv) Input offset voltage

Ans. Text book –II , Article 2.37, 3.22

c.When the inputs to a certain differential amplifier are v_{i1} = 0.1 sinφt and v_{i2} = –0.1 sinφt. It is found that outputs are v_{O1} = –5 sinφt and v_{O2} = 5 sinφt. When both inputs are 2 sinφt, the outputs are v_{O1} = –0.05 sinφt and v_{O2} = 0.05 sinφt. Find the CMMR in dB.

c) Ad= Vo1-Vo2/Vi1-Vi2= -5-5/0.1-(.1)

= -50

A common mode gain Acm= (Vo1-Vo2)cm/Vcm

=-0.05-0.05/2 = -0.05

CMMR= IAdI/IAcmI =50/0.05 =1000

CMMR= 20 $\log_{10}$(1000)= 60 dB Ans 6 marks

Q.7 a. Draw and explain the working of OPAMP integrator. Draw input and output waveforms of the circuit.

Ans. Text book –I , Article 4.3

b. Design a practical differentiator that will differentiate signals with frequencies upto 200 Hz. The gain at 10 Hz should be 0.1

b)Select R1 and C to produce break frequency fb that is well above fh = 200 Hz .Let us choose fb = 10 fh=2kHz,letting C=0.1 πF

$fb= 1/2\pi R1C$ hz=

$R1= 1/2\pi(2x10^3)(10^{-7}) = 796\Omega$

In order to achieve a gain of 0.1 at 10 Hz

Gain= AwRfC/A

$=0.1=\omega RfC=(2\pi \times 10)Rf(10^{-7}) =$

$Rf= 15.9\ k\Omega$

Q.8 a. What are the applications of Schmit Trigger? Explain the operation of Schmit Trigger.

Ans. Text book –II , Article 5.3

b. Draw the circuit of a Monostable Multivibrator using IC 555 timer and explain its operation.

Ans. Text book –II , Article 8.3

Q.9 a. Explain the basic technique used for DAC.

Ans. Text book –II , Article 10.2

b.List the features of LM 723 Voltage Regulator.

Ans. Text book –II , Article 6.4

c. As shown in Fig.1 Vin = 20V, R = 200Ω and Vz = 12V. If V_{BE} = 0.65V, **(6)**

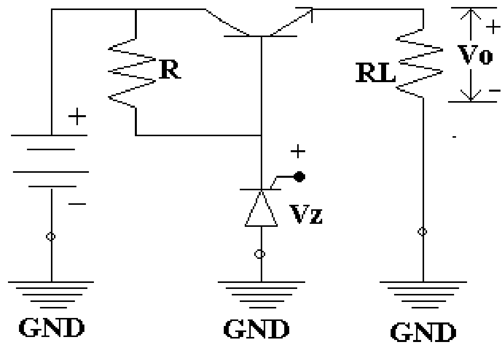

Fig.1

find
(i) Vo
(ii) The collector to emitter voltage of the pass transistor and
(iii) The current in the 200Ω resistor

C) Apply Kirchhoff's voltage law around the output loop

$V_{BE} = V_Z - V_O$

So $V_O = V_Z - V_{BE} = 12 - .065 = 11.35$ V Ans

$V_{CE} = V_{in} - V_o = 20 - 11.35 = 8.65$ V Ans

The voltage drop across 200Ω resistance is $V_{in} = V_Z$

= 20-12= 8V therefore the current in resistor is I = 8/200 = 0.04 A Ans

TEXT BOOK

I. **Electronic Devices and Circuits, Fourth Edition, David A Bell, PHI (2006)**

II. **Linear Integrated Circuits, Revised Second Edition, D. Roy Choudhury, Shail B. Jain, New Age International Publishers**