Registration No. : | | | | | | | | | | |

*Total number of printed pages – 7*

B. Tech

PCEC 4201(N)/CPES 5202(O)

# Third Semester Examination – 2010

## ANALOGUE ELECTRONICS CIRCUITS

**(New and Old Course)**

**Full Marks – 70**

**Time : 3 Hours**

***(Students are required to give their answer any one Course according to the Syllabus)***

## (NEW COURSE)

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer in brief all the following questions : 2×10

   (a) What is the need of a CMOS circuit ? Draw a basic CMOS circuit.

   (b) Compare fixed bias and self bias of BJT circuits from two points of view.

   (c) Prove that a FET is a voltage controlled device.

   (d) What do you mean by small-signal analysis ? How small is small ?

   (e) What is the need of a current-mirror ? Draw one circuit.

   (f) What is base-width modulation ? What is its effect ?

   (g) Draw the equivalent circuit of a CE amplifier using Miller effect. What is the upper 3-dB frequency of such a single-pole circuit ?

   (h) What is the transfer function of a CE amplifier at low frequencies? Give the location of its poles and zeros.

(i) What is frequency distortion ? Why does it take place ?

(j) What is a virtual ground ? What is its effect on an op-amp operation.

2. (a) For any single-transistor amplifier prove that $R_i = \frac{h_i}{1 - h_r A_v}$. 5

(b) Consider an emitter follower and show that as the emitter resistance $R_e \to \infty$ $R_i \to h_{ie} + \frac{1 + h_{fe}}{h_{oe}} \approx \frac{1}{h_{oe}}$. 5

3. (a) Show that the transconductance $g_m$ of a JFET is related to the drain current $I_{DS}$ given by $g_m = \frac{2}{|V_P|}\sqrt{I_{DSS} I_{DS}}$, where the symbols have their usual meanings. 5

(b) Do you get any junction in a JFET ? Why ? 2

(c) Draw the equivalent model of a voltage-divider biased JFET circuit under small signal conditions. 3

4. (a) Derive expressions for the stability factors of a voltage-divider biased CE amplifier. 6

(b) Derive the input resistance of a Darlington configuration. What is its utility? 4

5. (a) Derive an expression for the 3-dB frequency $f_H$ for a transistor at high frequencies. 5

(b) What is gain-bandwidth product ? Hence derive an expression for $f_T$. 5

6. (a) What is the maximum efficiency of a class A power amplifier? Derive this. Do you really achieve this efficiency ? Why ? 1+3+1+1

(b) Prove that a class B power amplifier is better than a class A power amplifier. 4

7. (a) Derive an expression for the voltage gain of an instrumentation amplifier. What are its applications? 4+1

(b) Verify that the differential gain of an operational amplifier $A_d$ is $\frac{1}{2} g_m R_c$ under the assumption of $R_s << h_{ie}$ and $r_{bb'} << r_{b'e}$. 5

8. (a) Derive the frequency of oscillation in a phase shift oscillator. How the phase shift is realized? 4+1

(b) What happens to the input resistance of a transconductance amplifier with feedback? Investigate. What kind of feedback is used here? 4+1

## ( OLD COURSE )

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer in brief all the following questions : 2×10



(a) Show that small signal low frequency h-parameters $h_{11}$, $h_{12}$, $h_{21}$, $h_{22}$ can be graphically determined from V-I characteristics of transistor.

(b) Draw the $r_e$ equivalent circuit for Emitter follower configuration of BJT and write the expression for voltage gain.

(c) Draw the circuit diagram for a Darlington configuration. Find the $\beta$ of the configuration when $\beta 1 = 80$ and $\beta 2 = 100$.

(d) Explain why square wave testing is required in amplifiers.

(e) Explain how $g_m$ is determined graphically in a JFET.

(f) What is Barkhausen criterion for oscillation ?

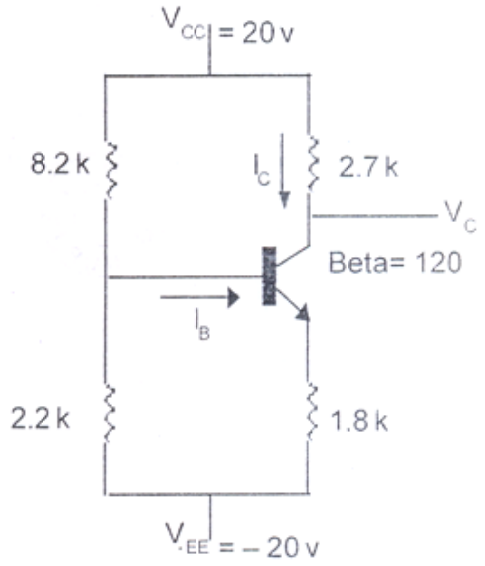
(g) What is miller effect ? Write the expression for miller effect input capacitance.

(h) What do you mean by CMRR ? How it affects the performance of Op-Amp ?

(i) What are the advantages of voltage series feedback ?

(j) What do you mean by distortion in a power amplifier ? Which power amplifier gives least amount of distortion ?

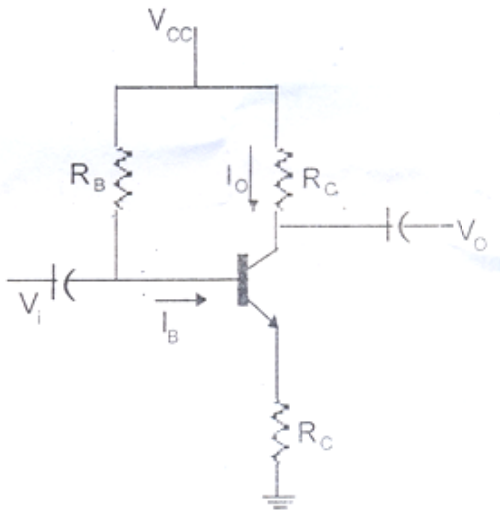
2. (a) Calculate $V_C$, $V_B$ for the following BJT biasing circuit. 6






(b) Derive the voltage gain for a Common Base configuration using its $r_e$ equivalent circuit. 4

3. (a) For the following network draw the AC equivalent circuit and derive the expression for Voltage gain, input impedance and output impedance. 6



(b) Explain Frequency response of a JFET. 4

4. (a) Explain how operating is selected in a Self Bias configuration of JFET. 5

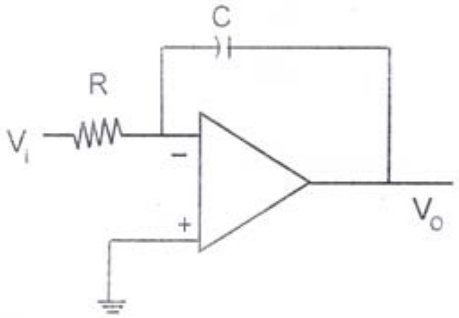
(b) Draw the Cascode configuration and explain its operation. 5

5. (a) Draw the Op-Amp phase shift Oscillator and derive the expression for frequency of Oscillation. 5

(b) Explain different DC offset parameters and frequency parameters of a Practical Op-Amp. 5

6. (a) For the Voltage–series feedback configuration, findout the expression for voltage gain, input impedance, output impedance. 6

(b) Find the expression for output voltage for the following configuration : 4




7. (a) For a class B power amplifier using a supply of $V_{cc}$ = 30v and driving a load of 16 ohm. Determine the maximum input power, Output power and transistor dissipation. 6

(b) Draw the circuit diagram of a transform coupled class-A amplifier and explain its operation. 4

8. (a) Explain how Op-Amp can be used for voltage summing application. 5

(b) Derive the efficiency of Series-Fed class A Amplifier. 5