Code : 041504

B.Tech 5th Semester Exam., 2014

ANALOG ELECTRONICS

Time : 3 hours

Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Answer any *seven* of the following : 2×7=14

   (a) What is an amplifier? What are various types of amplifiers?

   (b) Compare between frequency distortion and phase distortion.

   (c) What is the importance of hybrid parameters?

   (d) In a common emitter with a non-zero load resistance, the current gain bandwidth product reduces as load resistance increases. Why?

(e) Why is the input impedance of a Darlington emitter follower higher than that of a single-stage emitter follower?

(f) How does the number of stages in a multistage amplifier influence the cut-off frequencies?

(g) How are the amplifiers classified based on the biasing condition?

(h) Explain any one application of phase inverter circuit.

(i) What determines the frequency of oscillation in Wien bridge oscillator?

(j) Define noise figure and signal to noise ratio.

2. (a) Derive the equations for voltage gain, current gain, input impedance and output impedance for a BJT using low frequency h-parameter model for CB configuration. 8

(b) A transistor in CE configuration is driven by a voltage source V_S of internal resistance $R_S = 1\ k\Omega$. The load impedance is a resistor $R_L = 1\ k\Omega$. The h-parameters are $h_{ie} = 1 \cdot 1\ k\Omega$, $h_{re} = 2 \cdot 8 \times 10^{-4}$, $h_{oe} = 24\ \mu$ mho and $h_{fe} = 55$. Calculate A_i, Z_i, A_v. 6

3. (a) The input to a low-pass amplifier is a pulse of width t_p. Sketch the output waveshape. What must be the relationship between t_p and f_H in order to amplify the pulse without excessive distortion? 8

(b) Consider function of an amplifier with poles at 1 MHz and 2 MHz. Assume all the other poles and zeros are much larger than 2 MHz. Calculate the high 3-dB frequency. 6

4. (a) Draw the small signal equivalent circuit for an emitter follower stage at high frequencies. 7

(b) The total decibel voltage gain of a three-stage system is 120 dB. The second stage has twice the decibel voltage gain of first stage and the third has 2·7 times the decibel gain of the first. Calculate the decibel voltage of each stage. 7

5. (a) Discuss different types of noises in an amplifier briefly. What effect does noise have in an amplifier used in audio or video application? 7

(b) Explain the term 'path loss'. Derive the Friss transmission formula. 7

6. *(a)* Sketch the topology for a generalized resonant circuit oscillator using impedances Z_1, Z_2 and Z_3. At what frequency will the circuit oscillate? Under what condition does the configuration reduce to a Colpitt's oscillator and a Hartley oscillator? 7

(b) In the Colpitt's oscillator, $C_1 = 0{\cdot}2\ \mu F$ and $C_2 = 0{\cdot}02\ \mu F$. If the frequency of oscillation is 10 kHz, find the value of inductor. Also find the required gain for oscillation. 7

7. *(a)* Describe the construction of a phase-shift oscillator and explain its working. How is the feedback requirements met in it? 7

(b) An *R-C* phase-shift oscillator uses a bipolar junction transistor with $h_{fe} = 100$. If $R_C = 10\ k\Omega$, $R = 2\ k\Omega$ and $C = 0{\cdot}1\ \mu F$, will this circuit oscillate? If yes, find the oscillation frequency. 7

8. *(a)* Describe crossover distortion, what it is caused by, and how it is overcome. What penalty is paid for biasing an amplifier into class AB operation? 7

(b) A transformer coupled class A amplifier drives a load of 8 Ω through 3 : 1 transformer. With $V_{CC} = 24$ V, the circuit delivers 2 W to the load. The transformer efficiency is 80%. Find *(i)* power across the transformer primary and *(ii)* r.m.s. values of load current and primary current. 7

9. Write short notes on any *two* of the following : 7×2=14

(a) Low-frequency incremental model for a common source FET

(b) Darlington pair

(c) Quadrature oscillator

★ ★ ★