Code : 041504

B.Tech 5th Semester Exam., 2019

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 questions briefly : 2×7=14

(a) The ear is not sensitive to which type of distortion in the amplifier?

(b) Write the condition for approximate model of BJT in CE configuration.

(c) What is the phase difference between input and output currents in CE configuration?

(d) Why is the Bootstrap principle used in emitter follower circuit?

(e) What is Gain Bandwidth Product?

(f) Which of the BJT transistor currents is always the largest?

(g) What are the main purposes for which a CC amplifier may be used?

(h) What is the purpose of transformer coupling in transistor amplifier?

(i) Why is CB amplifier used as constant current source?

(j) Explain the Barkhausen criterion.

2. *(a)* Explain the phase distortion in amplifier and list the various causes for distortion.

(b) Draw the approximate small-signal equivalent circuit at low frequency for common-base amplifier with load resistance R_L. Compute the output resistance in terms of h parameter. 6+8=14

3. *(a)* The BJT is connected as a CE amplifier. Determine Z_i, Z_o, A_I and A_V using complete hybrid model.

(b) For an emitter bias BJT circuit (capacitor is bypassed), determine r_e, Z_i, Z_o and A_V. Given :

$R_B = 470\ k\Omega$, $R_C = 2{\cdot}2\ k\Omega$, $V_{CC} = 20\ V$
$R_E = 0{\cdot}56\ k\Omega$, $C_E = 10\ \mu F$, $\beta = 120$,
$r_o = 40\ k\Omega$ $C_c = 10\ \mu F$ 7+7=14

(Continued)

4. *(a)* Draw the single stage RC coupled BJT amplifier and discuss the effect of *(i)* input capacitance C_s, *(ii)* emitter bypass capacitor C_e and *(iii)* output capacitor C_c, on the frequency response.

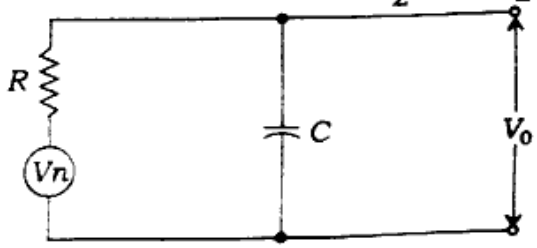
(b) Derive an expression for percentage tilt (P) in the output waveform for square symmetrical wave applied as input to an amplifier that behaves as high-pass circuit at low-frequency signal. 8+6=14

5. *(a)* Derive the expressions for input and output resistances in case of emitter follower BJT amplifier using its hybrid model.

(b) Derive the expressions for voltage gain in case of low-frequency common-drain FET amplifier and prove why voltage gain is less than unity. 8+6=14

6. *(a)* Find the mean-square value V_0^2 of the output noise voltage for the circuit shown in the figure given below. The circuit represents a generator

supplying Johnson noise to the RC combination. Prove that $\frac{1}{2}CV_0^2 = \frac{1}{2}\bar{k}T$:



(b) Compute overall lower 3-dB frequency for four interacting stages amplifier having individual stage lower 3-dB frequency, $f_1 = 40$ Hz, $f_2 = 100$ Hz, $f_3 = 50$ Hz and $f_4 = 10$ Hz. 9+5=14

7. *(a)* With a neat circuit diagram, explain the operation of a transformer coupled class A power amplifier.

(b) Compute the expression for current gain using small-signal equivalent circuit at high frequency for common-drain FET amplifier with load resistance R_L. 6+8=14

8. *(a)* Derive the relationship between t_p and high 3-dB frequency f_H in order to amplify the pulse without excessive distortion.

(b) Derive the frequency and condition of oscillation for FET phase-shift oscillator. 7+7=14

9. (a) Explain the working of a class B push pull amplifier. Prove that the maximum efficiency is 78·5%.

(b) Derive the expressions for frequency and condition of oscillation in case of Wien bridge oscillator. Determine the maximum and minimum frequency of oscillations of a Wien bridge oscillator circuit having a resistor of 10 kΩ and a variable capacitor of 1 nF to 1000 nF. 7+7=14

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