

Code : 041404

(3)

B.Tech 4th Semester Exam., 2018

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. Choose the correct answer from the following
 (any seven) : $2 \times 7 = 14$

(a) When there is no base current in a transistor switch, the output voltage from the transistor is

- ~~(i)~~ low
 (ii) high
 (iii) unchanged
 (iv) unknown

(e) Why do the internal capacitances of transistor at low frequencies treated as open circuits by completely neglecting their effects in analysis?

- ~~(i)~~ Due to high reactance
 (ii) Due to low reactance
 (iii) Due to moderate reactance
 (iv) None of the above

(f) Which among the below assertions is not a salient feature/property of CE amplifier?

- (i) High voltage gain
 (ii) High current gain
~~(iii)~~ High input resistance
 (iv) High output resistance

(g) In a power amplifier, the collector current flows for 270° of the input cycle. The operation is

- (i) class A
 (ii) class B
~~(iii)~~ class AB
~~(iv)~~ class C

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- (h) Which capacitor is used to block DC portion by allowing to pass only AC portion of the amplified signal to load?
- (i) Input coupling capacitor
 - ~~(ii) Bypass capacitor~~
 - (iii) Output coupling capacitor
 - ~~(iv) All of the above~~
- (i) When the circuit is switched on, the loop gain of an Wien bridge oscillator is
- (i) 1
 - (ii) more than 1
 - (iii) less than 1
 - (iv) about 0.5
- (j) If Q of an L - C circuit increases, then bandwidth
- (i) increases
 - ~~(ii) decreases~~
 - (iii) remains the same
 - (iv) Insufficient data
- ~~2/~~ (a) Explain the frequency distortion in amplifier and list the various causes for distortion.

- (b) If the emitter resistance increases, the collector voltage
- (i) decreases
 - ~~(ii) stays the same~~
 - (iii) increases
 - (iv) breaks down the transistor
- (c) Consider 49 cascaded amplifiers having individual rise time as 2 n sec, 3 n sec, ... 50 n sec. The input waveform rise time is 1 n sec. Then the output signal rise time is given by (assume output signal rise time is measured within 10 percent range of the final output signal)
- (i) 39-28 μ sec
 - (ii) 2.28 μ sec
 - (iii) 0.228 μ sec
 - (iv) 39.28 μ sec
- ~~(d)~~ Which capacitance(s) in hybrid π model represent(s) the storage of excess minority carriers at the base emitter junction?
- ~~(i) Diffusion capacitance~~
 - (ii) Transition capacitance
 - (iii) Both (i) and (ii)
 - (iv) None of the above

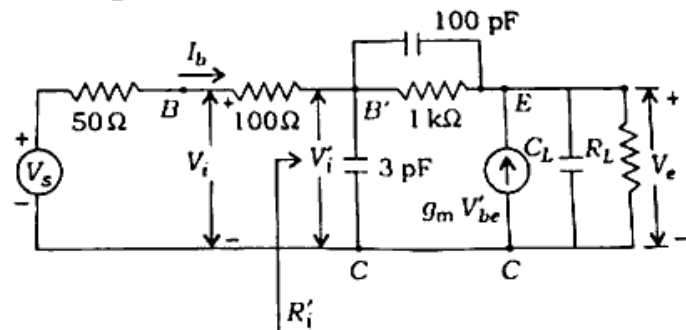
(5)

- ✓ (b) Draw the approximate small-signal equivalent circuit at low frequency for common-collector amplifier with load resistance R_L . Compute the input resistance in terms of h parameters.

7+7=14

3. (a) Draw and explain the working of low-frequency small-signal equivalent circuit of common base BJT.

- (b) Compute the input impedance R'_i using the equivalent circuit diagram given in figure below at frequency $f = 30$ MHz, where $g_m = 50$ mA/V, $R_L = 2$ k Ω and $C_L = 20$ pF.



6+8=14

- ✓ 4. (a) Draw and explain the working of Bootstrapped Darlington circuit.

- (b) Explain the f_β and f_T , which are bandwidths of the circuit and short-circuit current-gain bandwidth product respectively.

(6)

5. (a) The input to a low-pass amplifier is a pulse of width t_p . Sketch the output waveform and explain the intermediate steps involved to achieve the output.

- (b) What must be the relationship between t_p and high 3-dB frequency f_H in order to amplify the pulse without excessive distortion?

10+4=14

6. (a) Compute overall upper 3-dB frequency for four interacting stages amplifier having individual stage upper 3-dB frequency, $f_1 = 4$ MHz, $f_2 = 4.2$ MHz, $f_3 = 4.1$ MHz and $f_4 = 3.9$ MHz.

- (b) Define tilt. How is the tilt related to the low 3-dB frequency f_L ?

8+6=14

7. (a) Explain thermal and shot noises associated to the amplifier and briefly discuss the thermal-resistance noise voltage and mean-square shot-noise current in the context of thermal and shot noises respectively.

- (b) Compute the expression for current gain using small-signal equivalent circuit at high frequency for common-source FET amplifier with load resistance R_L .

7+7=14

8. (a) Explain the working of phase-shift oscillator.

(b) Derive expression for the oscillation frequency of a Colpitts oscillator and compute its value for given $L = 10 \text{ mH}$, $C_1 = 24 \text{ nF}$ and $C_2 = 240 \text{ nF}$. $7+7=1$

9. (a) Explain the working of class-B push-pull amplifier and compute the maximum conversion efficiency.

(b) Compute the bandwidth for single-tuned BJT amplifier using one parallel tuned circuit as load. $7+7=1$