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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JANUARY 2017

Course Code**: EC205**

Course Name**: ELECTRONIC CIRCUITS (AE, EC)**

Max. Marks: 100 Duration: 3 Hours

PART A

Question is 1 COMPULSORY and Answer EITHER Question 2 OR Question 3

Each Full Question Carries 15 marks.

1. a) Define the THREE stability factors of Common Emitter amplifier and derive expression for the Current stability factor of a potential divider bias CE amplifier circuit. **(8)**

   b) A Common Base amplifier is driven by a voltage source of internal resistance 60Ω. The load resistance is 20KΩ. The transistor has $\mathbf{h_{ib}}$ = 22Ω, $\mathbf{h_{rb}}$ = 0.0003, $\mathbf{h_{fb}}$ = -0.98 and $\mathbf{h_{ob}}$= 0.5μA/V. Compute the current gain A_I, input resistance $\mathbf{R_i}$, voltage gain $\mathbf{A_V}$, overall voltage gain $\mathbf{A_{Vs}}$, overall current gain $\mathbf{A_{Is}}$ (considering the source resistance also), and operating power gain $\mathbf{A_P}$. **(7)**

2. a) An ideal 1μS pulse from a pulse generator is fed to an amplifier. Calculate and plot the output waveform with a rise time of the capacitor 2.2 RC. The upper 3dB frequency is 0.1 MHz. **(7)**

   b) How amplifiers are classified based on their Q-points? Explain showing the positions of the Q-points on the respective load lines and current transfer characteristic curves for at least THREE types of classes. Also compare their merits and demerits. **(8)**

3. a) Define the small signal hybrid parameters of a Common Emitter configuration. Show how to determine their values from the characteristics. **(8)**

   b) Draw the circuit of a two-stage RC coupled amplifier. Derive expressions for its effective lower cut-off frequency and effective upper cut-off frequency. If the individual stages are having $\mathbf{f_L}$ = 20 Hz and $\mathbf{f_H}$ = 200 kHz, calculate the respective values for the cascaded two-stage. **(7)**

PART B

Question 4 is COMPULSORY and Answer EITHER Question 5 OR Question 6

Each Full Question Carries 15 marks.

4. a) What are the physical origins of resistances in the high frequency hybrid π model of a CE transistor amplifier? Explain the different parameters in the hybrid π circuit. **(7)**

b) Make a distinction between "voltage" feedback and "current" feedback in amplifier circuits. Discuss the merits in each case and derive expressions for the net output resistance in each case. **(8)**

5. a) Sketch the topology for the generalized resonant circuit oscillator, using impedances $\mathbf{z_1}$, $\mathbf{z_2}$ and $\mathbf{z_3}$. Derive the expression for the frequency of oscillation. Under what conditions does the configuration reduce to Colpitts oscillator? **(10)**

   b) Derive the equation which shows that the sensitivity of an amplifier reduces by applying negative feedback to the circuit. **(5)**

6. a) Deduce the high frequency equivalent circuit of a potential divider bias CE amplifier circuit. Derive the expression for the CE short circuit current gain as a function of frequency. Explain with frequency response characteristics diagram, the relationship between $\mathbf{f_\beta}$ and $\mathbf{f_T}$. **(12)**

   b) Draw the circuit of a cascode amplifier and explain its properties. **(3)**

PART C

Question is 7 <u>COMPULSORY</u> and Answer EITHER Question 8 OR Question 9

Each Full Question Carries 20 marks.

7. a) With neat circuit diagram and necessary waveforms, explain how a transistorized astable multivibrator is working as a free running oscillator. Derive the expression for the frequency. Show in the circuit diagram, how you can eliminate the rounding of the collector waveform and make the edges sharp? **(12)**

   b) An N-channel E-MOSFET used in a potential divider bias CS amplifier has $\mathbf{I_{D(ON)}}$= 4mA at $\mathbf{V_{GS(ON)}}$= 8V, $\mathbf{V_{GST}}$ = 4V, $\mathbf{g_m}$= 2 mS. Calculate values of (i) $\mathbf{V_{GS}}$, (ii) $\mathbf{V_{DS}}$, (iii) $\mathbf{I_D}$ and (iv) output Voltage, if $\mathbf{R_1}$=60kΩ, $\mathbf{R_2}$ = 40kΩ, $\mathbf{R_D}$ = 6kΩ, $\mathbf{V_{DD}}$ = 15V and the ac input signal = 80mV. **(8)**

8. a) Using fictitious generator block diagram, show how a Bootstrap generator can produce linear sweep voltage by constant current charging. Draw a transistorized circuit and waveforms to explain the Bootstrap action to generate linear sweep. **(12)**

   b) A Class B push-pull power amplifier is supplied with $\mathbf{V_{CC}}$ = 50V. The signal swings the collector voltage down to $\mathbf{V_{min}}$ = 5V. The total dissipation in both transistors is 40W. Calculate the total output power and conversion efficiency. **(8)**

9. a) Draw the circuit of a series pass voltage regulator which uses a feedback. Explain its working when the input voltage as well as load current varies. Design your circuit to deliver 6V, 100mA maximum load current. **(12)**

   b) Draw the circuit of a Drain feedback bias circuit for E-MOSFET. Explain its working and properties. **(8)**