53 (EC 301) ELDC

2017

ELECTRONIC DEVICES AND CIRCUITS

Paper : EC 301

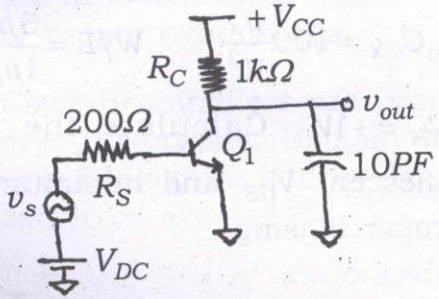
Full Marks : 100

Time : Three hours

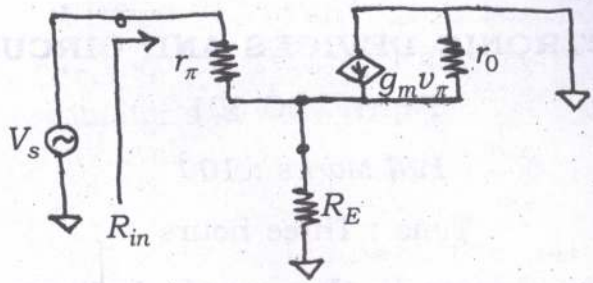
The figures in the margin indicate full marks for the questions.

*Answer **any five** of **six** questions.*

1. *(a)* Calculate the $-3dB$ Bandwidth of the amplifier shown below. The transistor is biased with $1{\cdot}2mA$ of current and $\beta = 100$, parasitic capacitances are $e_\pi = 10PF$ and $e_\mu = 1PF$. 6



(b) Calculate the expression for the input resistance for the small-signal diagram shown below: 5

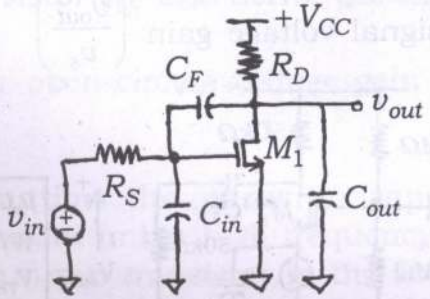


(c) Describe the of Buck regulator and its operations mention the duty cycle for the output. 9

2. (a) A resistance of $5k\Omega$ is appearing between the Drain terminal and the battery $\overline{V}_{DD}$, of an n-MOS transistor. It is used to realize a transconductance of $5m$ Siemens for saturation mode. $\mu_n C_{OX} = 100\frac{\mu_A}{V^2}$, $W/L = \frac{5\mu_n}{1\mu_m}$ and $V_{TH} = +1V$. Calculate the value of quiescent V_{GS} and minimum V_{DD} for proper biasing. 5

(b) Describe the operation of emitter follower as a Class-A output stage. Hence plot the transfer characteristics and derive the power efficiency of the stage. 10

(c) Derive the expression for input impedance for an amplifier shown below using Millen's approximation. 5

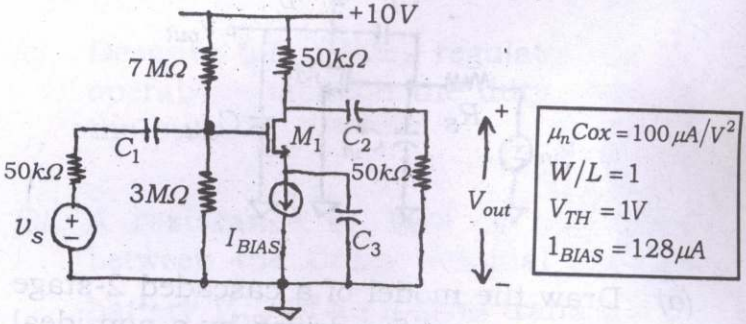


3. (a) Draw the model of a cascaded 2-stage voltage amplifier driven by a non-ideal voltage source and load ; hence show the various loading effects with the help of proper expressions. 2+3

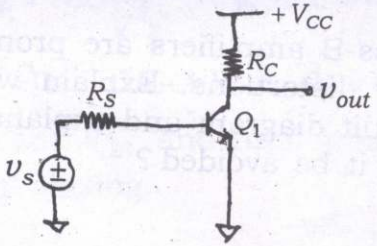
(b) Class-B amplifiers are prone to cross over distortions. Explain with proper circuit diagram and explanation. How can it be avoided ? 8+2

(c) Derive the expression for small-signal transconductance for an n-MOS transistor biased in saturation mode, with a small signal voltage v_s applied between gate and source terminal. 5

4. (a) A biased amplifier circuit is shown below, calculate the value for small signal voltage gain $\left(\frac{v_{out}}{v_s}\right)$ 5



(b) Derive the expression for the Gain-Bandwidth product (GBW) for the amplifier shown below: 10

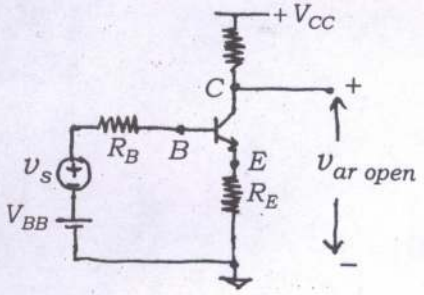


(c) Draw the circuit diagram of a capacitively coupled and a direct coupled common-emitter amplifier, hence draw the small-signal diagram for different frequency bands. 5

5. (a) Draw the circuit diagram of a capacitively coupled common emitter amplifier with emitter-degeneration resistor R_E and derive the expressions for open-circuit voltage gain $\left(\frac{v}{V}\right)$. 10

(b) Mention the parasitic capacitances present in the high frequency band for an n-p-n transistor in the active mode and hence draw the high-frequency model of this transistor. 5

(c)



Derive the expressions for the small signal and Quiescent voltage at the emitter terminal w.r.t ground. 5

6. *(a)* Why voltage regulators are necessary in the electronics? Classify the regulators and draw the circuit for various regulator types and describe the operation in brief. 2+2+8

(b) Describe the operation of Buck boost regulator and write the expressions for duty cycle. 8