Total No. of Questions – [08]　　　　　　　Total No. of Printed Pages: 04~~3~~

G.R. No. ⬚

Paper Code- U218-134 (BE-FF)

# MAY 2019/ENDSEM

## S. Y. B. TECH. (E&TC) (SEMESTER - I)

## COURSE NAME: Semiconductor Devices & Circuits

## COURSE CODE: ETUA21174

### (PATTERN 2017)

Time: [2Hours]　　　　　　　　　　　　　　　[Max. Marks: 50]

**(*) Instructions to candidates:**
1) Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed
4) Use suitable data where ever required

**Q.1)a)** Explain voltage divider biasing circuit with neat circuit diagram and write its equations. [6 marks]

**OR**

**b)** Calculate the Q point values of $I_B$, $I_C$ and $V_{CE}$ for the voltage divider bias circuit, if $V_{CC}$=12 V, $R_1$=8K$\Omega$, $R_2$=4 K$\Omega$, $R_C$=1K$\Omega$ and $R_E$=1 K$\Omega$. Assume silicon transistor with $\beta$= 50. [6 marks]

**Q. 2) a)** N-channel JFET common source amplifier without bypass capacitor has $R_G$=1M$\Omega$, $R_D$=50K$\Omega$, $R_S$=1 K$\Omega$, $g_m$=2mA/V, $r_d$=10K$\Omega$, Determine $A_v$, $R_i$ and $R_o$. [6 marks]

**OR**

**b)** Draw and explain transfer characteristics and output characteristics of n-channel JFET. [6 marks]

**Q. 3)a)** Voltage divider biasing circuit using n-channel E-MOSFET has $V_{DD}$= 5V, $R_1$=30 K$\Omega$, $R_2$= 20 K$\Omega$, $R_D$= 20K$\Omega$, $V_T$= 1V, $K_n$= 0.1 mA/v$^2$. Determine the co-ordinates of Q point such as $V_{DSQ}$, $V_{GSQ}$ and $I_{DQ}$. [6 marks]

**OR**

**b)** Explain following non-ideal effects for MOSFET.
i) finite output resistance
ii) Temperature effect [6 marks]

**Q. 4) a)** For CS amplifier using MOSFET determine $g_m$, $I_D$ and $r_o$ if $V_T$= [4 marks]
1 V, $K_n$= 0.8 mA/V², $\lambda$= 0.01 /V, $V_{GSQ}$= 3V.

**OR**

**b)** Draw complete AC equivalent model for n-channel MOSFET
CS amplifier with bypass capacitor. Write small-signal
voltage gain expression for CS amplifiers. [4 marks]

**Q. 5) a)** Draw and explain current sink and current source circuit
using n-channel MOSFET. [6 marks]

**b)** Draw MOSFET as a practical switch model. Explain the
significance of each component. [4 marks]

**c)** Explain in detail MOS act as a active diode and resistor with
neat circuit diagram. [4 marks]

**OR**

**Q.6) a)** For the CMOS amplifier shown in figure, the parameters are:
$V_{TN}$= 1 V, $V_{TP}$= -0.8 V, $k'_n$= 80 µA/V², $k'_p$= 40 µA/V², $(W/L)_1$=
80, $(W/L)_2$= 1, and$V_{DD}$= 3.3 V. $\lambda_n$ = 0.02 V⁻¹ and $\lambda_p$ = 0.01 V⁻¹.
Drain current, $I_D$ = 0.1 mA. Determine the small-signal
voltage gain and output resistance. [6 marks]
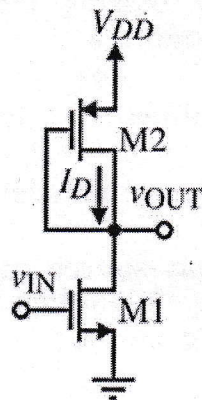


**b)** Sketch NMOS source follower amplifier circuit and its small-
signal equivalent circuit. Write expression for small-signal
voltage gain and output resistance. [4 marks]

**c)** Explain CMOS inverter as a amplifier with neat circuit
diagram [4 marks]

**Q. 7) a)** For the FET source follower circuit, calculate values of Avf,
$R_{if}$, $R_{of}$ and $R'_{of}$. Assume $g_m$= 2 mA/V and $r_d$ = 40 KΩ and
R=4.7KΩ. [6 marks]
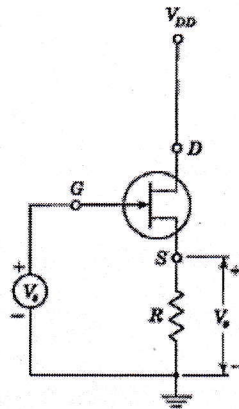
**b)** A Colpitts Oscillator circuit having two capacitors of 24nF and 240nF respectively are connected in parallel with an inductor of 10mH. Determine the frequency of oscillations of the circuit. [4 marks]

**c)** An amplifier has open loop gain of 100 and it's lower and upper cut off frequency of 100 Hz and 100 KHz respectively. A feedback network with feedback factor of 0.99 is connected to the amplifier. Calculate the new lower and upper cut off frequencies. [4 marks]

**OR**

**Q. 8) a)** Draw block diagram of voltage series and current series feedback topology. [6 marks]

**b)** Draw neat circuit diagram of Colpitt oscillator and explain in detail. [4 marks]

**c)** Draw circuit diagram and AC equivalent of voltage series feedback amplifier and write its final expression for ac parameters. [4 marks]