

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)  
B. Tech. Sem - II E&TC :SUMMER- 2022  
SUBJECT : SEMICONDUCTOR DEVICES & CIRCUITS-I

Day : Wednesday  
Date : 3/8/2022

S-24102-2022

Time : 10:00 AM-01:00 PM  
Max. Marks : 60

**N.B.:**

- 1) All questions are **COMPUSLORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram **WHEREVER** necessary.
- 4) Assume suitable data if necessary.
- 5) Use of non-programmable **CALCULATOR** is allowed.

**Q.1** State the limitations of half-wave rectifier. Show that the efficiency of a half-wave rectifier is 40.6%. **(10)**

**OR**

**Q.1** Draw the circuit diagram for a voltage quadrupler and state its working. What are the applications of a voltage multiplier circuit? **(10)**

**Q.2** Design a fixed current bias circuit using a BJT with  $\beta = 100$ ,  $V_{cc} = +15V$  to set the Q-point at (5V, 3mA). **(10)**

**OR**

**Q.2** For a fixed current bias circuit,  $R_b = 180k\Omega$ ,  $R_c = 2k\Omega$ , and  $V_{cc} = 12V$ . Assuming  $V_{be} = 0.7V$ , find the dc operating point (Q point) when  $\beta = 50$ . **(10)**

**Q.3** A common emitter circuit uses a transistor with  $h_{fe} = 50$ ,  $h_{ie} = 1.2 k\Omega$ , and  $h_{oe} = 10^{-6} S$ .  $R_c = 3.9 k\Omega$ ,  $R_e = 4.7 k\Omega$ ,  $R_1 = 68 k\Omega$ ,  $R_2 = 56 k\Omega$ ,  $R_L = 82 k\Omega$ . Calculate the input impedance, output impedance, voltage gain, current gain and power gain. **(10)**

**OR**

**Q.3** For a common base voltage amplifier, derive the expressions for input impedance, output impedance, voltage gain and current gain. Draw the ac equivalent circuit for the same. **(10)**

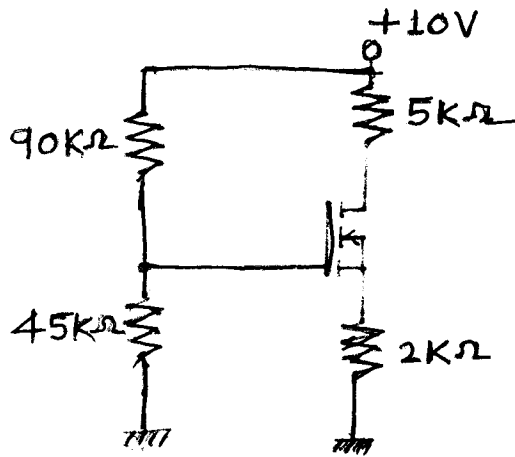
**Q.4** Design a gate bias circuit for JFET to have  $I_{d(max)} = 3mA$  and  $V_{DS(min)} = 10V$ , given  $V_{DD} = 25V$ ,  $V_{GS(off)} = -6V$ ,  $I_{DSS} = 8mA$ ,  $R_G = 1 M\Omega$ . **(10)**

**OR**

**Q.4** Draw a FET common source amplifier circuit with bypassed  $R_s$  and its AC equivalent circuit and derive the equation for its voltage gain. **(10)**

**P.T.O.**

- Q.5 Determine  $I_{DQ}$  and  $V_{DSQ}$  for the following circuit. Given:  $V_T = 1V$ ,  $K' (W/L) = 2mA/V^2$  (10)



OR

- Q.5 State and explain the various MOSFET models used for design and analysis of MOSFET circuits. (10)

- Q.6 Explain the concept of current mirror with a basic BJT current mirror circuit. (10)

OR

- Q.6 Explain the Widlar current source with a neat circuit diagram. (10)

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