Total number of printed pages: 5 **Programme(UG)/Semester/UIE302**

2023

Electronic Devices and Circuits

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1.	a)	Derive the expression for density of states function of a cubic crystal with lattice constant 'a'.	10
	b)	Derive the expression for Fermi Dirac distribution function.	10
2	a)	Derive the expression for thermal equilibrium electron concentration in the conduction band of an N-type semiconductor	8
	b)	Derive the expression for space charge width of an abrupt pn junction under zero bias condition.	7
	c)	State and explain Hall effect in Semiconductor	5
3.	a)	Define static and dynamic resistance of a diode. Obtain the expression for ac resistance of a diode at room temperature.	10
	b)	What is load line? Draw and explain the concept of load line of a diode.	4
	c)	Draw the circuit diagram and output waveforms of Positive simple series clipper and Positive biased series clipper	6
4	a)	Determine the following for the fixed-bias configuration of Fig. 1 i. IBQ and ICQ. ii. VCEQ. iii. VB and VC . iv. VBC .	8

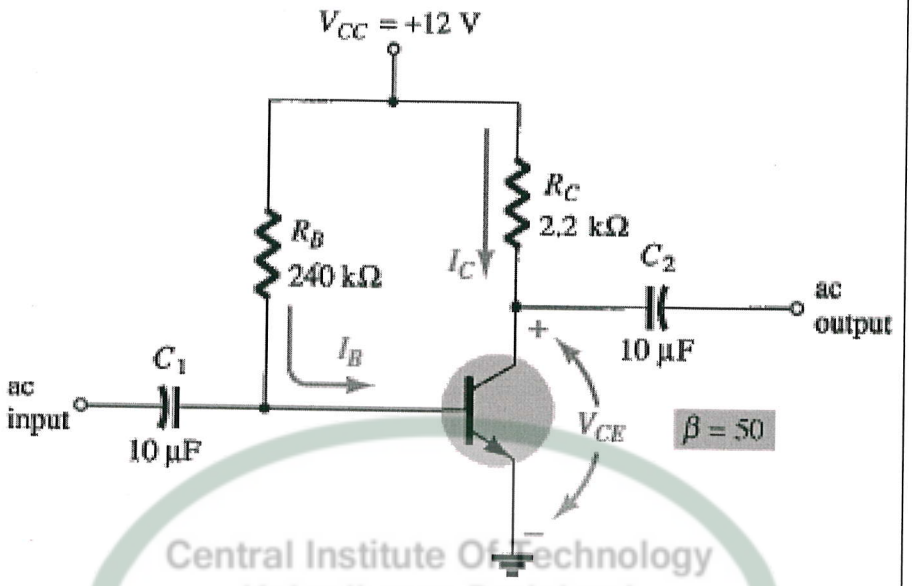


Fig. 1

b) Given the load line of Fig. 2 and the defined Q -point, determine the required values of VCC , RC , and RB for a fixed-bias configuration. 6

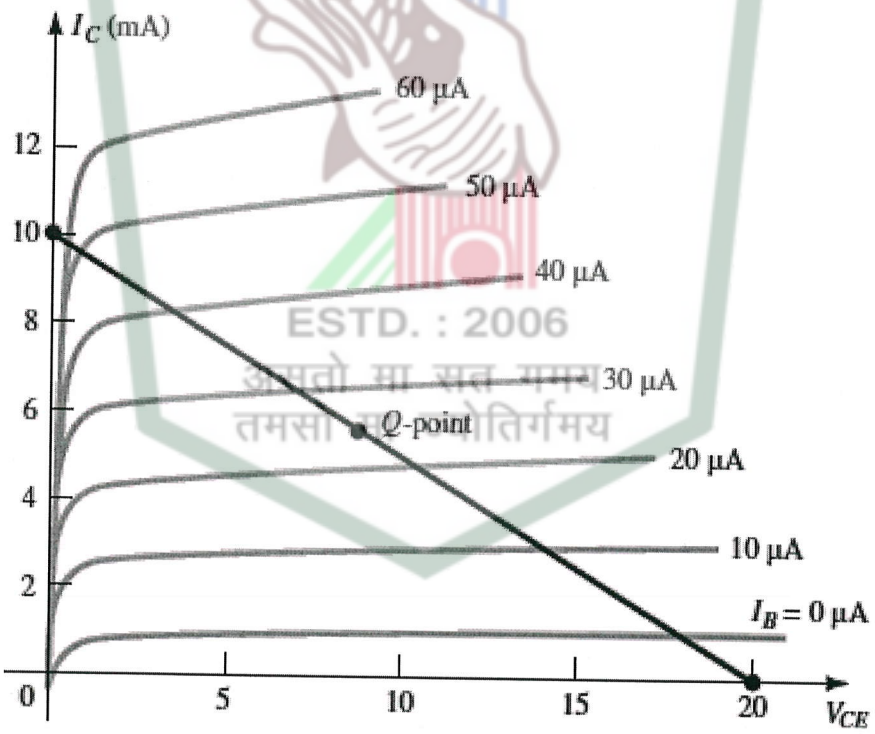
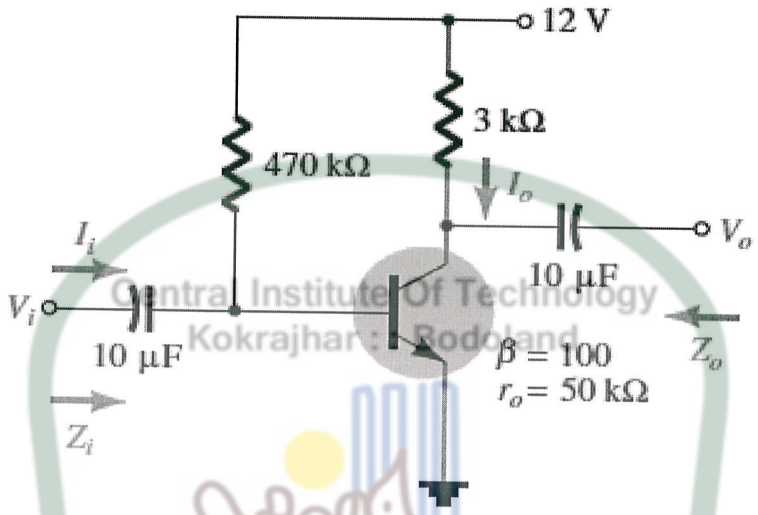
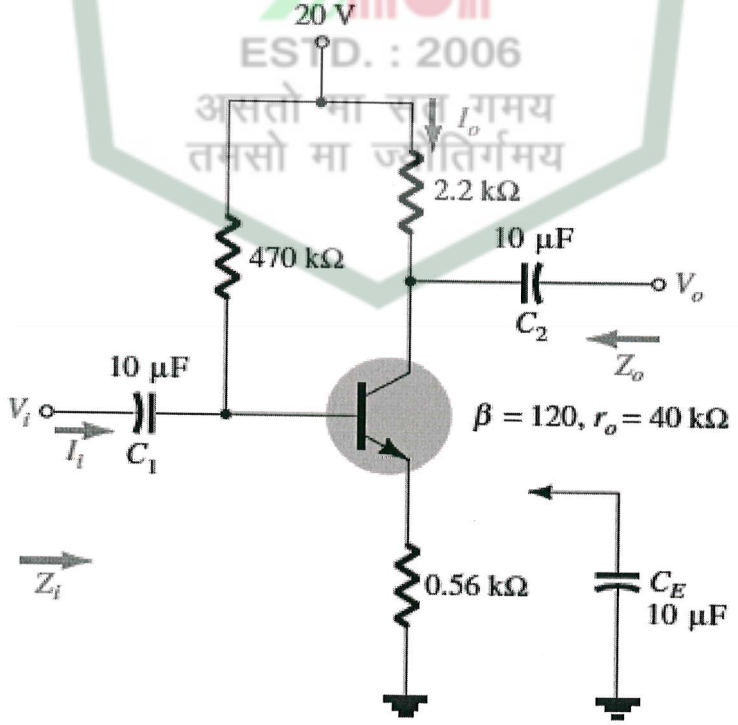
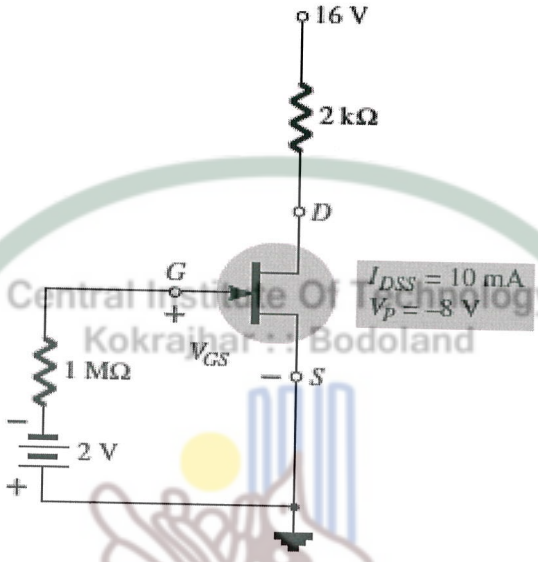
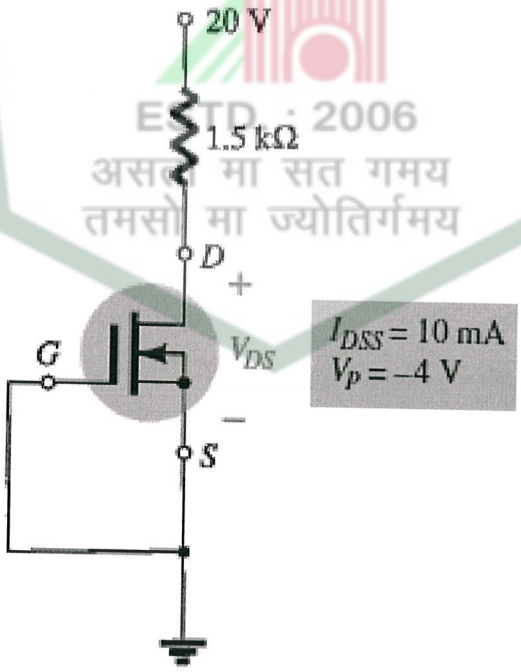
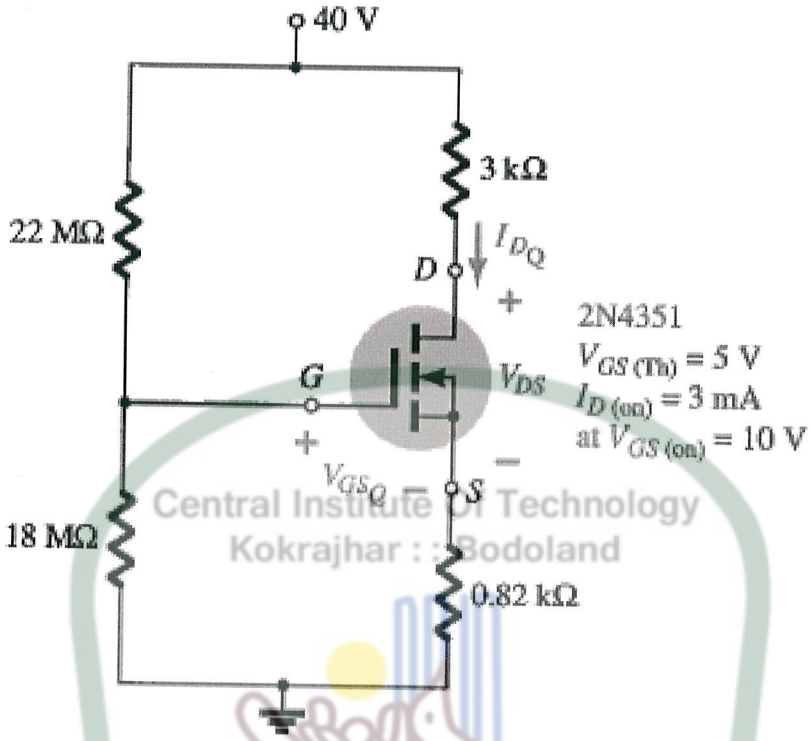


Fig. 2

	c)	For the network of Fig. 3 : i. Determine re . ii. Find Zi (with ro = infinity). iii. Calculate Zo (with ro = infinity). iv. Determine Av (with ro = infinity). v. Repeat parts (c) and (d) including ro = 50 k in all calculations and compare results.  Fig. 3	6
5	a)	For the network of Fig. 4 , without CE (unbypassed), determine: a. re . b. Zi . c. Zo . d. Av .  Fig. 4	8

	b)	Determine the following for the network of Fig. 5: a. VGSQ. b. IDQ. c. VDS . d. VD . e. VG . f. VS .  Fig. 5	7
	c)	Determine VDS for the network of Fig. 6.  Fig. 6	5

6	a)	Determine IDQ, VGSQ, and VDS for the network of Fig. 7.  Fig.7	10
	b)	Calculate the efficiency of a transformer-coupled class A amplifier for a supply of 12 V and outputs of: i. V(p) = 12 V. ii. V(p) = 6 V. iii. V(p) = 2 V	6
	c)	For a class B amplifier providing a 20-V peak signal to a 16 ohm load (speaker) and a power supply of VCC = 30 V, determine the input power, output power, and circuit efficiency.	4
7	a)	Derive the expressions for gain for voltage series and voltage shunt feedback	5+5=10
	b)	Determine the maximum efficiency of a Class B amplifier.	10