PAPER ID-310534

Subject Code: KEC056

Roll No: | | | | | | | | | | | | | |

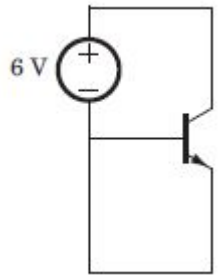
B. TECH
(SEM-V) THEORY EXAMINATION 2020-21
ADVANCE SEMICONDUCTOR DEVICE

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

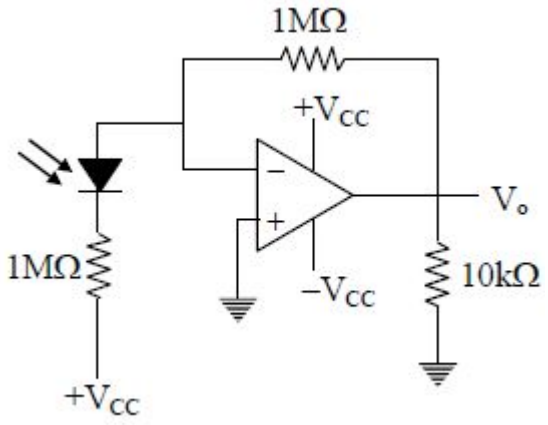
1. Attempt *all* questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	A diode has reverse saturation current Is=10^{-10} A and non ideality factor n =2. If diode voltage is 0.9 V, Calculate the diode current.	2	
b.	Explain MESFETs in brief.	2	
c.	Determine the region of operation for the transistor shown in circuit. 	2	
d.	Discuss Thyristors in brief.	2	
e.	What are Charge-Coupled Devices?	2	
f.	Six volts is applied across a 2 cm long semiconductor bar. The average drift velocity is 10^4 cm/s. Calculate the electron mobility.	2	
g.	What are Nonvolatile Memory Devices?	2	
h.	Explain MODFETs in brief.	2	
i.	What is the difference between Schottky Diode and conventional P-N junction diode?	2	
j.	List two properties of Magnetic Sensors.	2	

SECTION B

2. Attempt any *three* of the following:

Qno.	Question	Marks	CO
a.	Derive an expression for thermal equilibrium concentration of holes in the valence band of semiconductor.	10	
b.	Consider a silicon p-n junction with a uniform acceptor doping concentration of 10^{17} cm^{-3} on the p-side and a uniform donor doping concentration of 10^{16} cm^{-3} on the n-side. No external voltage is applied to the diode. Given: kT/q = 26 mV, ni = 1.5x10^{10} cm^{-3}, ε_{si} = 12ε_o, ε_o= 8.85x10^{-14} F/m, and q = 1.6x10^{-19} C. Calculate the charge per unit junction area (nC cm-2) in the depletion region on the p-side	10	
c.	Explain IMPATT Diodes with Static Characteristics and Dynamic Characteristics. In case IMPATT Diode having carrier drift velocity V_d=4X10^5 m/s, drift region length, L=12um, breakdown voltage is 90v, maximum operating voltage is 100v, maximum operating current is 100mA, efficiency	10	

	n=10%. Determine the resonant frequency and maximum CW Output power.		
d.	What are transferred Electron devices? Explain the working of any one of them.	10	
e.	What is responsivity? A p-i-n photo diode of responsivity 0.8A/W is connected to the inverting input of an ideal op-amp as shown in the figure, +Vcc = 15V, –Vcc = –15V, load resistor R_L = 10 kohm. If 10μW of power is incident on the photodiode, then Calculate the value of the photocurrent (in μA) through the load. 	10	

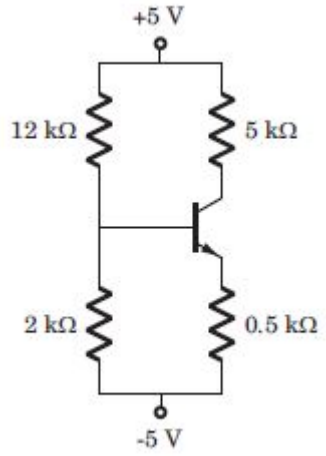
SECTION C

3. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	A silicon abrupt junction has dopant concentration **Na**=2X10^{15} cm^{-3} and $\mathbf{N_d}$=2X10^{15} cm^{-3}. The applied reverse bias voltage is V_R= 8 V. (i) Calculate the maximum electric field $\mathbf{I}E_{MAX}\mathbf{I}$ in depletion region is (ii) Calculate the space charge region	10	
b.	What do you mean by Rectifying contact? State the condition for which the junction between a metal and n-type semiconductor will work as a rectifying contact. Draw the energy band diagram of rectifying contact formed between a metal and n-type semiconductor at equilibrium condition.	10	

4. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	The current gain of the transistor shown in the circuit is β =100. Calculate the values of Q-point (I_{CQ} , V_{CEQ}).	10	

			
b.	Discuss briefly the principle of operation of JFET. Also derive an expression for the I-V Characteristics of the device.	10	

5. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain the operation of Tunnel diode. Draw the I-V characteristics of diode. List applications of Tunnel diode.	10	
b.	Describe the working of BARITT Diode with diagram & mathematical expressions.	10	

6. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	List some Applications of Light Emitting Diode. A GaAs PN junction LED has following parameters Dn=25 cm^2/s, Dp=12 cm^2/s, Nd=5X10^{17} cm^{-3}, Na=10^{16} cm^{-3}, τ_{no} =10 ns, τ_{po} =10 ns. Calculate the injection efficiency of the LED.	10	
b.	Write short notes on (i) Light Emitting Diode (ii) P-N Junction Solar Cell (iii) Double Hetero-structure LASER diode.	10	

7. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain the working of photo-diode with I-V Characteristics.	10	
b.	What is Sensor? Distinguish between Thermal Sensors and Mechanical Sensors.	10	