B.Tech. 2nd Semester Examination, 2021

BE 205: BASIC ELECTRONICS

Full Marks: 70 **Time: 3 Hours**

Group A (Answer any **Five** questions)

1. $2\times 5 = 10$

a) Why does a pure semiconductor behave like an insulator at absolute zero temperature? 2

b) Why is Si preferred over Ge in the manufacture of semiconductor device? 2

c) Why the width of the base region of a transistor is kept very small compare to other regions? 2

d) What are the parameters that control the pinch off voltage of JFET? 2

e) How does the negative feedback affect the performance of an inverting amplifier? 2

f) What is Fermi level? 2

g) What is modulation index and percentage of modulation? 2

h) State the two De-Morgan's theorem. 2

Group B (Answer any Four questions) 15×4= 60

2.

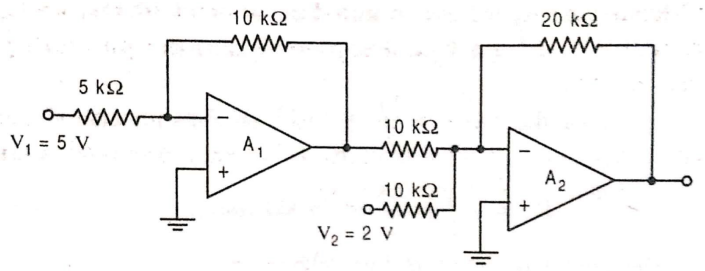
a) In an intrinsic Si, the fermi level lies near middle of the band gap. How does Fermi level move when it is doped with (i) Phosphorus (ii) boron atoms? 2

b) Can the Fermi level be pushed up into the conduction band? If yes, explain how and if not explain why? 3

c) Draw the energy band diagram for (i) an intrinsic (ii) an n-type and (iii) a p-type semiconductor. Indicate the positions of the fermi, the donor, and the acceptor levels. 6

d) Briefly explain the operation of Full wave rectifier. 4

3.	a)Explain different components of current flowing though the structure of a N-P-N transistor	5
	b) In a CB configuration of a PNP transistor the current amplification factor is 0.988. Determine the base current if emitter current is 1.2 mA. Neglect collector leakage current.	2
	c)Explain with diagram the following regions in a transistor in CE mode (i) Active (ii)Saturation (iii) Cutoff.	3
	d) Draw the equivalent circuit of zener diode as voltage regulator and explain.	4
	e) What is an LED?	1
4.	a) What do you mean by Zener and Avalanche breakdown in P-N junction semiconductor diode?	2
	b) Sketch the basic structure of an N-channel JFET and draw the volt-ampere (V/I) characteristics. Explain each region in the graph.	1+1+2
	c) What is dynamic resistance of a JFET?	2
	d) Why are N-channel MOSFET preferred over P-channel ones in integrated circuit?	2
	e) What is the significant difference between the enhancement type and depletion type MOSFET?	3
	f) Explain the term ‘channel’ in a JEFT.	2
5.	a) What is virtual ground?	2
	b) Explain the use of an OPAMP as an integrator.	4
	c) Design a noninverting amplifier circuit that is capable of providing a voltage gain of 15. Assume ideal op-amp and resistance should not exceed 30 KΩ.	2
	d) Find the output of the following circuit.	4



e) State the type of number systems present in digital systems and mention their radix. 3

6. a)Simplify the following expressions:

(i)$(\bar{A}+B+\bar{C})(\bar{A}+B+D+E)(C+D)$ 3+2

(ii) $\bar{A}\bar{B}C+BC+AC$

b) Using K-map deduce the simplified expression for the following function f(A,B,C,D)=∑m(0,2,3,6,7,8,10,11,12,15) 3+1

Realise the function using logic gates. 4

c) Perform BCD addition of 974+595

d) Convert $(10001110)_2$ to its hexadecimal equivalent. 2

7. a) Write down the truth table of a full adder. Derive the expressions for the full adder and implement the full adder using logic gates. 5

b) What is a multiplexer?Explain the operation of a 4×1 MUX with the help of diagram. 4

c) Draw the diagram of 3 to 8 decoder and briefly explain how it operates. 4

d)What are sequential circuits and how do they differ from combinational circuits? Give examples of sequential circuits. 2

8. a) What is an S-R flip flop. Draw the state table for the same. 3

b) How is T flip flop derived from JK flip flop? Draw the diagram. 2

c) What do you understand by signal modulation? State the types of analog modulation. 3

d) What is frequency modulation? Derive the expression for the modulated wave in frequency modulation. 4

e) Draw the chip diagram of a 4-bit magnitude comparator and explain with reference to this diagram how the comparator works. 3