2018

BASIC ELECTRONICS

Paper : EC 201

Full Marks : 100

Time : Three hours

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

Answer *any five* questions out of *seven.*

1. (a) Distinguish between intrinsic and extrinsic semiconductors with the help of energy band diagram. 5

   (b) Derive the expression for conductivity of a semiconductor material. 5

   (c) Explain the cause of diffusion current. Derive its expression for a non-uniformly doped p-type material. 5

(d) Explain how a built-in potential is created when a p-type and n-type materials are joined together. Derive its expression. 5

2. (a) Derive the expression for equilibrium minority carrier concentration profile in a p-n junction diode when it is forward biased. Using this equilibrium concentration profile, derive the diode equation. 5+5=10

(b) Plot the characteristics of ideal and real p-n junction diode. List out the main differences between them in forward and reverse bias regions. 5

(c) Explain the mechanism of Avalanche breakdown. 5

3. (a) Find the output waveforms of the following circuits, where D is an ideal diode. 4+4=8

(i)

(ii)
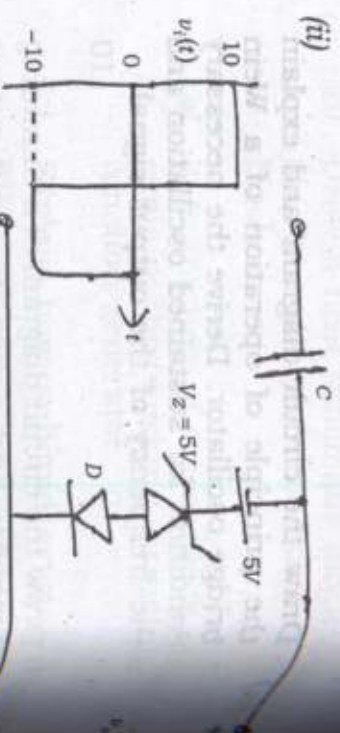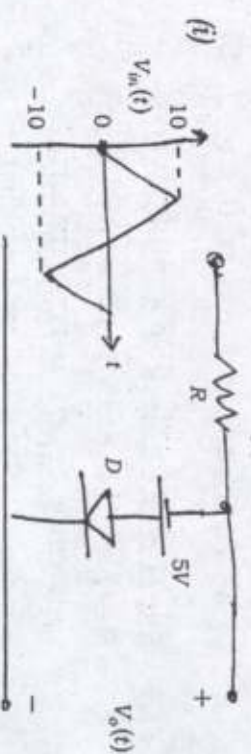
(b) Draw the circuit diagram of a full wave rectifier with capacitor filter and explain its working with the help of input and output waveform. Derive the expression for ripple factor at the output. 6+6=12

4. (a) Explain the working of BJT in its active mode of operation with the help of characteristics. Define the terms emitter injection ratio, base transport factor and current gain in common base configuration, using proper mathematical expressions. 10

(b) Draw the schematic diagram of an n-channel MOSFET and derive the expression for drain current in ohmic and saturation region of operation. Discuss the importance of transconductance for using MOSFET as an amplifier. 10

5. (a) Draw the circuit diagram and explain the principle of operation of a Wein bridge oscillator. Derive the necessary condition for sustained oscillation and the frequency of the output signal. 10

(b) Draw the circuit diagram of a Summing Amplifier and derive its input-output relationship. 5

(c) Explain the mathematical step involved in converting a fractional number in decimal system to binary system. 5

6. (a) Implement EXOR gate using NAND gates alone. 4

(b) Design the digital circuit to implement the following boolean function :

$$f(A,B,C,D) = \sum (m_1, m_3, m_4, m_6, m_{11}, m_{15})$$ 4

(c) What are the drawbacks of SR flip-flops ? Explain how it could be overcome. 4

(d) With the help of a block diagram, explain the working principle of *any* digital voltmeter. 8

7. (a) Draw a neat schematic block diagram of CRO and explain the function of each block. 8

(b) With the help of a neat block diagram, explain the working principle of a function generator. 8

(c) Explain how a liquid crystal display works and give *two* applications for its use. 4

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