53 (EC 201) BSEL

2014

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.*

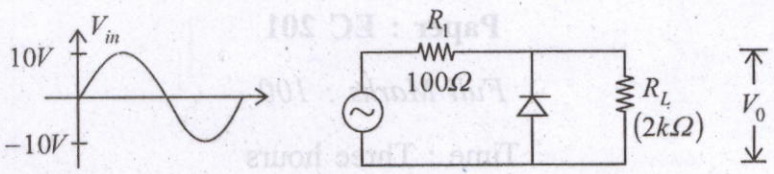
1. *(a)* Explain the *V-I* characteristics with reference to the diode current equation. 3

   (b) Explain the physical mechanism of Avalanche and Zener breakdowns in a *p-n* diode. 4

   (c) Draw and explain the working of a bridge type F.W.R. with necessary waveforms.

   Derive the expression for average DC load current (I_{DC}) and efficiency (η). 10

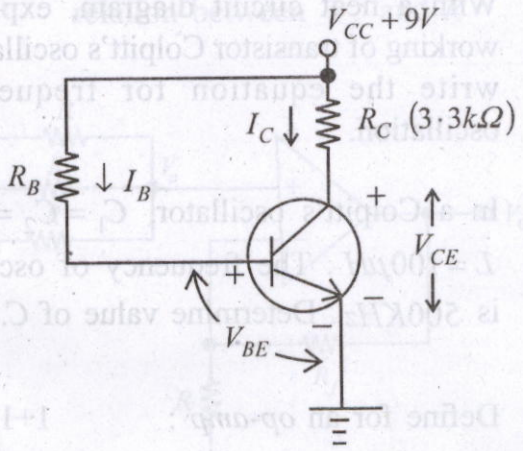
(d) Sketch the output waveform for a clipper circuit shown in the figure below. Also obtain the peak magnitude of the output waveform. Assume silicon diode. 3



2. (a) Draw the input and output characteristics of a transistor in CE configuration. Show the different regions of operation. What are the biasing requirements for the transistor to operate in these regions ? 10

(b) Define alpha and beta of a transistor and obtain the relationship between them. 5

(c) For the transistor shown in figure below, the value of β is 100. Calculate the value of R_B that will just saturate the transistor. Assume $V_{CE(sat)} = 0 \cdot 3V$ 5



3. (a) Explain the working of *N*-channel FET and define the parameters of JFET. 10

(b) In what respect, a JFET differs from MOSFET ? With the aid of neat sketch give the cross section of *N*-channel enhancement MOSFET and explain its construction, basic operation and characteristics. 10

4. *(a)* Draw the circuit of a two-stage *R-C* coupled amplifier and explain the function of each component in the circuit. Also sketch the frequency response of the amplifier showing the different regions and bandwidth. 10

(b) With a neat circuit diagram, explain the working of transistor Colpitt's oscillator, and write the equation for frequency of oscillation. 6

(c) In a Colpitt's oscillator, $C_1 = C_2 = C$ and $L = 100\mu H$. The frequency of oscillations is $500KHz$. Determine value of *C*. 4

5. *(a)* Define for an *op-amp* : 1+1+1+2=5

(i) CMRR

(ii) PSRR

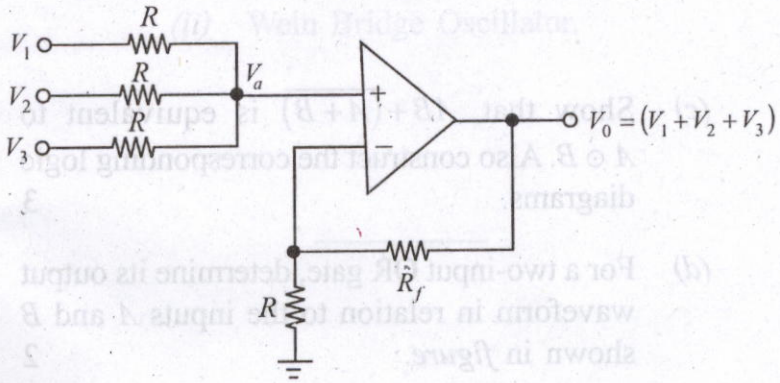
(iii) Slew Rate

(iv) Virtual ground.

(b) What are the ideal characteristics of *op-amp* ? 5

(c) Show how *op-amps* can be used as a non-inverting amplifier and derive expression for its voltage gain. 5

(d) Given a non-inverting summing amplifier circuit and the output equation, find out the relation between R_f and R 5

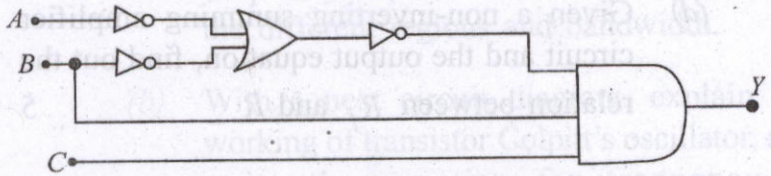


6. (a) Perform the following : 5

(i) $(57 \cdot 6)_8 = (?)_2 = (?)_{16}$

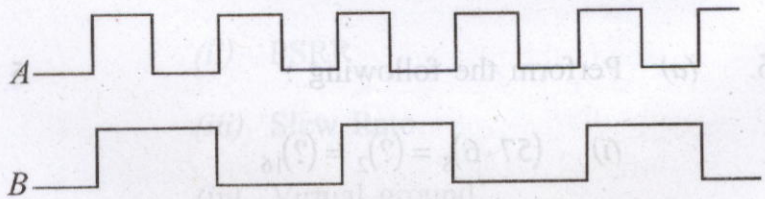
(ii) $(44030)_{10} = (?)_2 = (?)_{16}$

(b) Write a boolean expression for the output Y in figure below and determine the truth table 5



(c) Show that $AB+\overline{(A+B)}$ is equivalent to $A \odot B$. Also construct the corresponding logic diagrams. 3

(d) For a two-input OR gate, determine its output waveform in relation to the inputs A and B shown in *figure*. 2



(e) What is a flip-flop ? Draw the circuit diagram of S-R and J-K flip-flop and explain its operation with the help of truth table. 5

7. *(a)* Draw block diagram of a CRO and explain the function of each stage. 6

(b) Describe the principle of working of LED. 6

(c) Explain the following in brief : 4+4=8

(i) SMPS

(ii) Wein Bridge Oscillator.
