(Time: 3 Hours)   [Total Marks: 80]

3.: (1) Question No. 1 is compulsory.
    (2) Solve any three questions from the remaining five.
    (3) Figures to the right indicate full marks.
    (4) Assume suitable data if necessary and mention the same in answer sheet.

1   Attempt any 4 questions:
     (a) Give ideal characteristics of op-amp and give their practical values.   [05]
     (b) Compare linear and switching voltage regulator.   [05]
     (c) Design a circuit for $V_O = V_1 + V_2$ using single op-amp and few resistors. [05]
     (d) What are the advantages of switch capacitor filters?   [05]
     (e) Explain op-amp as window detector.   [05]

2   (a) With the help of a neat diagram and voltage transfer characteristics explain the   [10]
          working of an inverting Schmitt trigger. Derive the expressions for its threshold
          levels.
     (b) Draw a neat circuit diagram of a Wien bridge oscillator using op-amp. Derive its   [10]
          frequency of oscillation. What are the values of R and C for frequency of
          oscillation to be 965 Hz?

3   (a) Draw the circuit diagram of a square and triangular waveform generator using op-   [10]
          amp and explain its working with the help of waveforms.
     (b) The circuit given in Fig. 3(b) is similar to that of internal diagram of IC555 with [10]
          slight modifications in the internal resistances to value 2R. Analyse this circuit
          and draw the waveforms at output terminal v_{out} and across the capacitor C.
          Comment on the duty cycle of output waveform when i) R_A is less than R_B, ii) R_A
          is equal to R_B, and iii) R_A is greater than R_B.
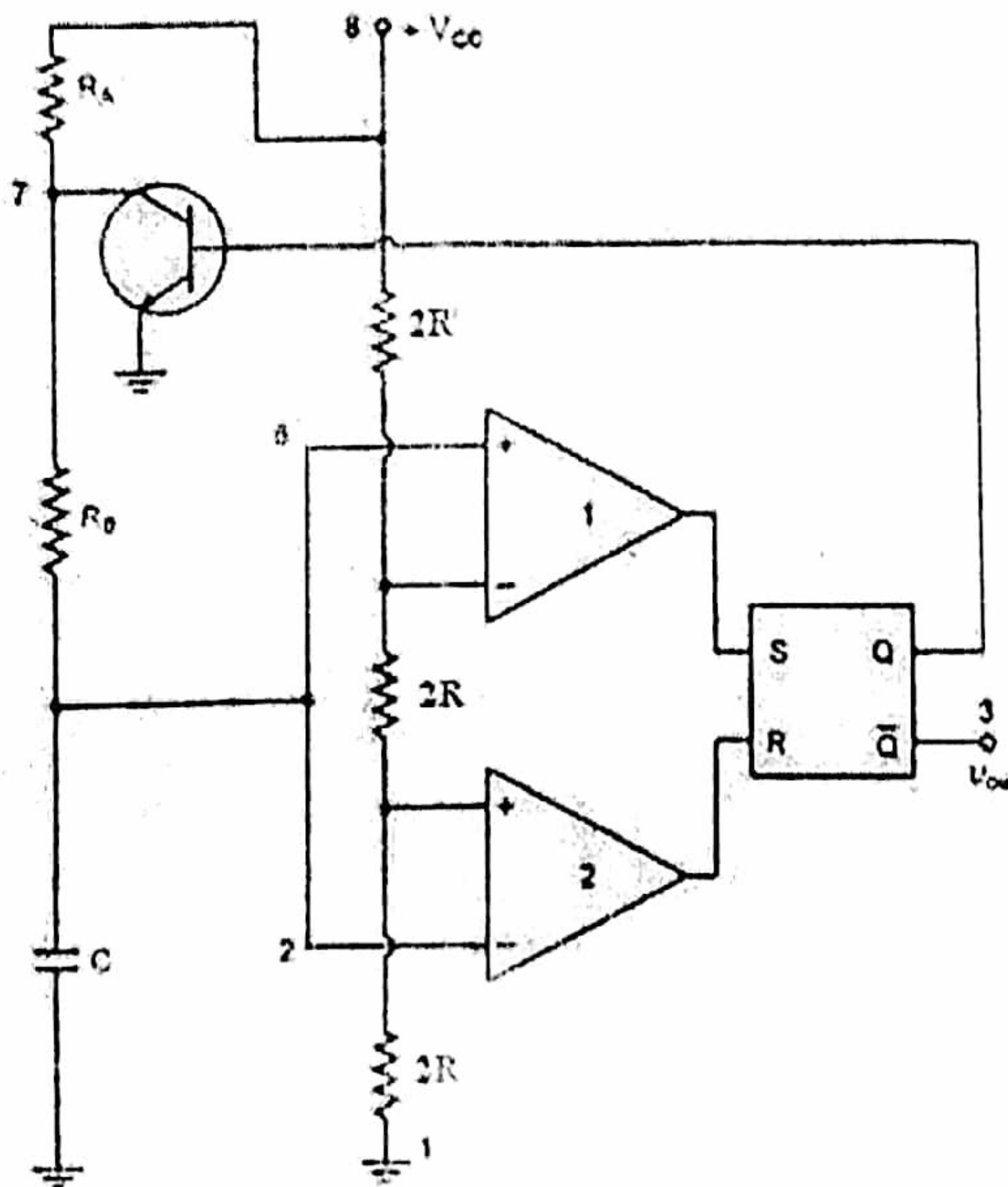

Fig. 3(b)
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Q.4 (a) Design a second order Butterworth high pass filter for cut off frequency of kHz and pass-band gain of AF=2.

(b) With a neat circuit derive an expression for the output of an instrumentation amplifier.

Q.5 (a) With neat circuit explain R/2R ladder digital to analog converter.

(b) With the help of a functional block diagram explain the working of voltage regulator LM317 to give an output voltage variable from 6 V to 12 V to handle maximum load current of 500 mA.

Q.6

Short notes on: (Attempt any four)
(a) Effect of swamping resistor.
(b) Current fold-back protection circuit in voltage regulator.
(c) Voltage to Current converter.
(d) Peak detector circuit.
(e) Working of PLL IC 565.

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