Tutor Marked Assignment
ELECTRICAL CIRCUITS AND ELECTRONICS

Note: Attempt all questions. Symbols have their usual meanings. The marks for each question are indicated against it.

1. State, **with reasons**, whether the following statements are True or False. (2×10)

   i) Ideal current source has zero internal resistance.

   ii) Suppressor grid in pentode is kept at anode potential.

   iii) Bipolar junction transistor (BJT) is a voltage controlled device.

   iv) Highest current gain is obtained in common base configuration of an amplifier.

   v) Ripple factor of a center tapped full wave rectifier is greater than that of a bridge rectifier, which uses four diodes.

   vi) When same voltage is applied to both the inputs of an op-amp the output voltage is infinite.

   vii) IC LM317 is a small signal amplifier used to amplify audio frequency voltage.

   viii) Largest decimal number represented by a 3-digit hex number is 999.

   ix) All the logic gates can be realized using combination of only OR and NOT gates.

   x) In a CRO sweep generator output is given to the vertical deflection plates.

2. a) Find the Thevenin equivalent for the circuit shown in Fig. 1 between terminals *a* and *b*. Calculate the current in and the voltage across the load resistance R_L. (5)
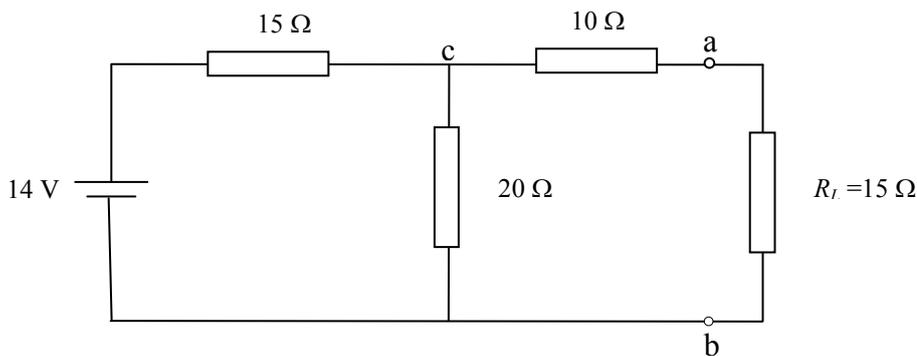
Fig. 1

   b) Bandwidth of an *RLC* series circuit is 100 kHz. If the value of *L* is 0.1 mH then determine the values of *R* and *C* in order to make *Q* of this circuit equal to 5. (5)

3. a) State the biasing conditions for *E-B* and *C-B* junctions in a BJT for its proper operation. Explain the output characteristics of a CE configuration of an amplifier. (1+4)

   b) Explain the effect of doping on the energy band diagram of a semiconductor. (5)

4. a) Why is it necessary in the case of cascade amplifier to use coupling network between the two stages? What are the advantages of transformer coupling? (2+3)

b) On the basis of their biasing, with the help of appropriate diagrams, justify the uses of Class *A*, *AB* and *C* amplifiers for various applications. (5)

5. a) State the Barkhausen criterion for sustained oscillation. Explain the operation of Colpitts oscillator. A Colpitts oscillator oscillates with frequency 10 MHz, determine the equivalent capacitance, *C* forming tank circuit with 0.1 mH inductor. (1+2+2)

   b) The turns ratio of a transformer used in half wave rectifier is 20:1. The primary is connected to the power mains: 220 V, 50 Hz. If the diode resistance in forward bias is 20 Ω and the load resistance, R_L is 500 Ω, determine

   i)   the peak value, the dc value and the rms value of current;
   ii) the ripple factor; and
   iii) the rectification efficiency. (3+1+1)

6. a) You want to amplify an input signal with 10 mV amplitude and 50 MHz frequency. Which characteristics of op-amp will be significant in this case? What will be the value of these parameters? Why? (2+2+2)

   b) Design and draw a circuit using an op-amp to get + 8 V at output for input less than +4 V and −8 V at output for input greater than +4 V. (4)

7. a) For Fig. 9.4 of your study material, the formula for feedback loop gain is

$$A_{V_{CL}} = \frac{-A_V}{1 - \dfrac{A_V}{1 + (R_2 / R_1)}}$$

   where A_V is the fixed gain of IC380. Design and draw the circuit using IC380 to obtain the gain of 100. (5)

   b) Design a regulated power supply using LM 337 to provide −20 V output. (5)

8. a) Convert binary number 110011101_2 to its BCD code. (3)

   b) Divide 1010001_2 by 1001_2. (2)

   c) Design and draw a Mod-9 counter. (5)

9. a) Design a half adder using only NAND gates. (5)

   b) Design a circuit of basic function generator to generate a triangular wave of 1 kHz frequency and ± 10 V amplitude. (5)

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