

M.Tech. / I Sem.

NANO SCIENCE AND NANO TECHNOLOGY
Paper : NSNT – 105 : Basic Electronics

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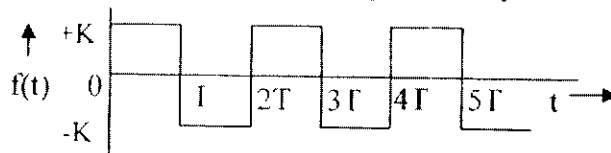
Time 3 hours

Maximum Marks 38

(Write your Roll No on the top immediately on receipt of this question paper)
 Attempt 5 questions in all Question No 1 is compulsory

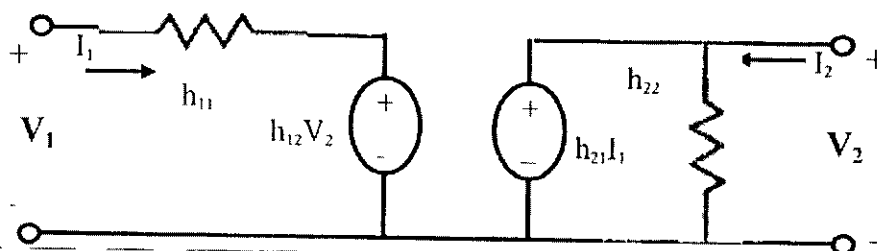
1 Attempt any four of the following: (4 x 2.5)

- (a) What are the ideal characteristics of an operational amplifier Explain briefly, why CMRR of an op-Amp should be large to design an amplifier
- (b) Define α and β for a transistor Derive the relationship between α and β
- (c) Draw the hybrid equivalent circuit for a common emitter amplifier Derive the voltage gain of the amplifier in terms of h-parameters
- (d) What is the reciprocal network? Determine the condition of reciprocity for impedance parameters in a two port linear network
- (e) Transform the function corresponding to periodic square wave shown below



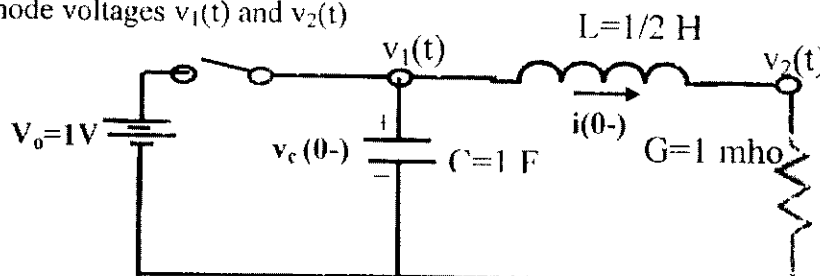
(f) Transform the function corresponding to periodic square wave shown in the figure below. In the two port network shown below, compute the h-parameters using the data

- a with the output terminals short circuited, $V_1=25V$, $I_1=1A$, $I_2=2A$
- b with the input terminals open circuited, $V_1=10V$, $V_2=50V$, $I_2=2A$



2 (a) Find the current $i(t)$ flowing in a series RC circuit, when a comp voltage $21(t-3)$ is applied at a time $t = 0$. Assume no charge on capacitor C at $t = 0$ 3

(b) At a time $t = 0$, switch in the following network is opened. Determine the node voltages $v_1(t)$ and $v_2(t)$ 4



3 (a) How a depletion region is formed in a PN junction diode? Obtain an expression for the barrier potential in terms of charge densities (5 5)

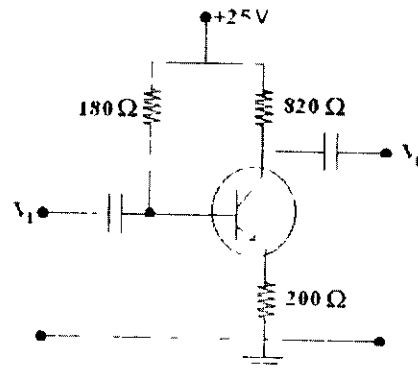
(b) Explain the dependence of reverse saturation current in a p-n diode on applied voltage and temperature? (1 5)

4 (a) For a given op-amp, CMRR is 10^4 and the common mode gain is 10. Find the differential gain of the op-amp (1)

(b) Derive expression for the close loop gain of the inverting and non-inverting amplifiers (6)

5 (a) Give a comparison between the three configurations (CE, CB and CC) of transistor (1)

(b) Find I_c and V_{CE} for the following circuit if β of the transistor is 80 (2 5)



(c) Describe briefly the construction of a Schottky diode. Explain its working with the help of a energy band diagram. How is it different from a PN junction diode? (3 5)

6 (a) Distinguish between a bipolar junction transistor and a junction field effect transistor (1)

(b) Drawing the basic structure of a p-channel field effect transistor, explain its working. Draw its common source drain characteristics. Define pinch-off voltage (4)

(c) Differentiate between enhancement and depletion-type MOSFETs (2)
