भारतीय प्रौद्योगिकी संस्थान पटना

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Basic Electrical Science-EE-101 Time: 3 hour, FM=50

Q-1 answers all parts of the questions. 5

(a) Represent $(123.4)_8$ into decimal number and binary number equivalent.
(b) Find the value of (1000001-0110111) and (1111101+0110111)
(c) Convert $(0.513)_{10}$ into octal. (d) Get the result in digital form (-15+7) and (-19-17) (e) Define gray codes and its importance.

Q.-2 (a) Show maxterms and minterms for three binary variables by a table and verify by an example that it follows DeMorgans theorems. 2
(b) Simplify the following Boolean expressions to a minimum number of literals 2

(i) $ABC+A\bar{B}+AB\bar{C}AC$ (ii) $(x+y+z')+(x'+z')$
(c) converts each of the following functions into sum of product and product of sum form 2
(i) $(AB+C)(B+C'D)$ (ii) $x'+x(x+y')(y+z')$

Q.-3 Solve the following Boolean functions using Karnaugh maps. 4
(i) $F(A,B,C,D)=\Sigma(4,5,6,7,15)$ (ii)$F(A,B,C,D)=\Sigma(2,3,6,10,12,13,14,15)$;
(iii) $ABC+A'B'C+AB'C'+A'BC$ (iv) $AB'C+B'C'D'+BCD+ACD'+A'B'C+A'BC'D$

Q.-4 Write characteristic table of JK and D flip flops and design asynchronous up counter and synchronous down counter using any 3 flip flops. 5

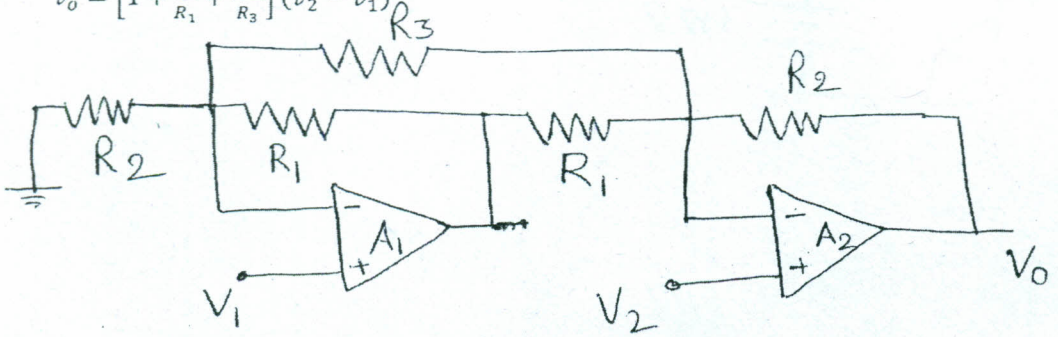
Q.-5 A speaker of 9 Ω is connected to 10 V source via an ideal transformer. The internal resistance of source is 1 Ω. Determine the turns ratio of transformer for which the speaker receives maximum power. 2

Q.-6 A 5 kVA, 200/20V (rms) single phase transformer connected to a 200 V (rms) single phase supply draws a current of $1\angle 45°$ A (rms). Determine the load impedance Z_2 connected to the secondary of the transformer. Assume ideal transformer. 2

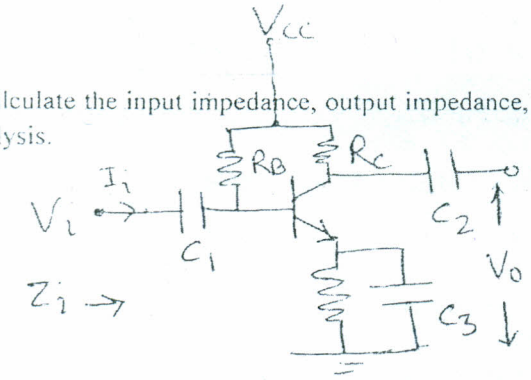
Q.-7 A single phase 100 kVA, 1000/100 V transformer gave the following test results: 6
Open-circuit test (HV side open)
100 V, 6.0 A, 400 W
Short-circuit test (LV side shorted)
50 V, 100 A, 1800 W
Derive an approximate equivalent circuit referred to HV side.

Q.-8 for the given instrumentation amplifier, using two ideal OP-AMPs, verify the following equation. 6

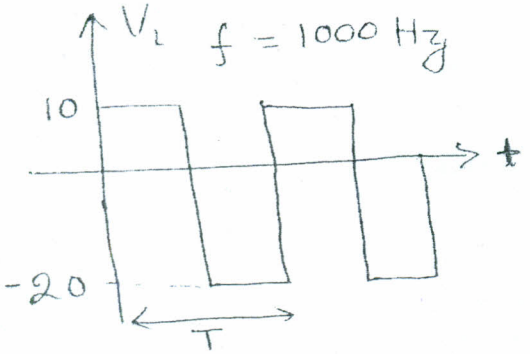
$$v_o = \left[1 + \frac{R_2}{R_1} + \frac{2R_2}{R_3}\right](v_2 - v_1)$$

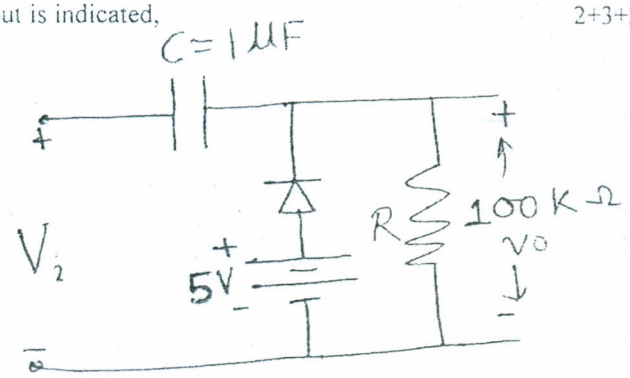


Q.-9 Calculate the input impedance, output impedance, voltage gain and current gain for the given circuit in case of BJT AC analysis. 6

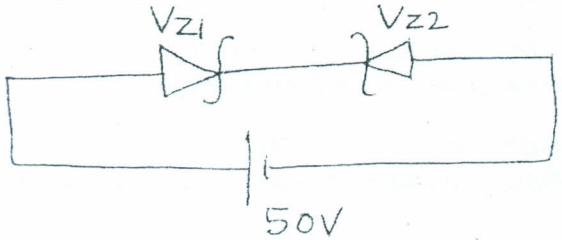


Q.-10(a) Draw the v_0 for the given network where input is indicated, 2+3+3





(b) The Zener diode V_{Z1} given in figure has saturation current of 20 micro ampere and reverse breakdown voltage of 100V where as the corresponding values for diode V_{Z2} are 40 micro ampere and 40V. Determine the current through the circuit.



(c)The BJT in the given circuit has maximum I_{co}=2micro ampere and current amplification factor β_{min}=50, and β_{max}=150. Obtain the value of resistor that can prevent collector voltage falling below 8V.