Registration No. :

Total number of printed pages – 3

## Second Semester Examination – 2011

## BASIC ELECTRONICS

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any five from the rest.*
*Symbols carry their usual meaning.*
*The figures in the right-hand margin indicate marks.*

1. Answer the following questions :                                    2 × 10

   (a) PN junction diode made up of which material (Si, Ge, GaAs) has highest barrier potential ?

   (b) Calculate the shift of forward characteristic of a silicon diode if temperature increases from 293 K to 383 K.

   (c) Why open loop op-amp configurations are not used in linear applications ? Explain with reasons.

   (d) Determine the DC resistance of a diode at $V_D = -20$ V if its reverse saturation current is 1 μA.

   (e) What is a load-line ? How it is used to calculate the operating point ?

   (f) The CMRR of a differential amplifier is 55dB. If its gain in differential mode $(A_d)$ is 1200 then calculate its gain in common mode $(A_{cm})$.

   (g) What is the virtual short circuit and virtual ground concept in OP-AMP ?

   (h) Write down the DeMorgan's theorem. Also show the corresponding logic diagram.

   (i) What is a Lissajous pattern ? Write down its uses.

   (j) Find the percentage increase in reverse saturation current of a PN junction diode if the temperature is increased from 25°C to 50°C.

P.T.O.

2. (a) What is the condition of oscillation ? Derive the expression of frequency of oscillation and also the condition of oscillation in a RC-phase shift oscillator.

5

(b) Implement the function $F(A, B, C, D) = \Sigma m (1, 3, 4, 11, 12, 13, 14, 15)$ using a MUX. Also implement the function into NAND only logic after simplifying the expression.

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3. (a) Calculate the output of the diode circuit shown below. Input is a sinusoidal signal.

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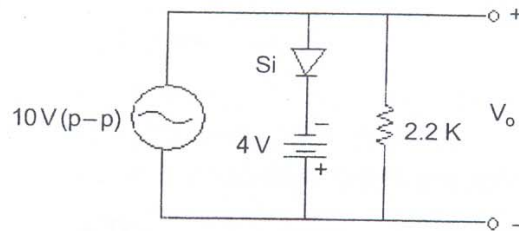


(b) For the circuit shown in figure, determine the values of $v_1, i_1, i_2, v_o, i_L$ and $i_o$. Also determine the voltage gain $v_o/v_i$, current gain $i_L/i_i$ and power gain $P_o/P_i$.

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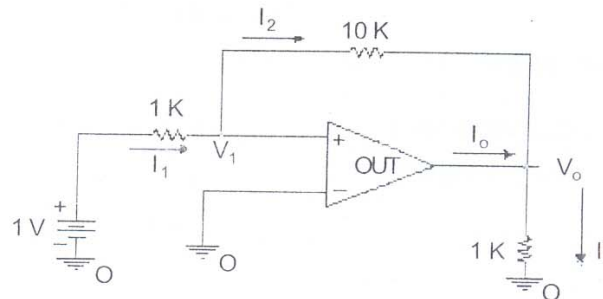


4. (a) A crystal diode having an internal resistance $r_f = 20\,\Omega$ is used for full-wave rectification. If the applied voltage is $V = 50 \sin 2t$ and the load resistance is $R_L = 800\,\Omega$, determine the following :

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(i) $I_m, I_{dc}, I_{rms}$ of output

(ii) AC power input and DC power output

(iii) Ripple factor.

(b) The output power of an amplifier is 100 W when the load resistance is 10 ohm. The harmonic distortion in the output is 4%. Determine the voltage gain if the input is 2 Volts. What is the required feedback ratio if the harmonic distortion is to be restricted to 0.02 %.

5

5. (a) A particular diode, for which $n = 1$, is found to conduct current 3 mA with a junction voltage of 0.7 V.  5

    (i) What is saturation current $I_s$ ?

    (ii) What change in junction voltage will increase the diode current by a factor of 10 ?

  (b) Sketch the output waveform of $V_0$ when a 10 V (peak) triangular wave with period T is applied at input of the circuit given in the figure below :  5
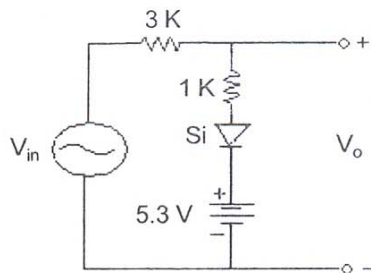


6. (a) A transistor has $i_B = 100\ \mu A$ and $i_C = 2$ mA, find $\alpha$ and $\beta$ of the transistor. If $i_B$ changes by $+25\ \mu A$ and $i_C$ changes by $+0.6$ mA, find the new value of $\beta$.  5

  (b) Why biasing circuits are required for a transistor ? Discuss different biasing techniques.  5

7. (a) Derive an expression for sum and carry output of a full adder circuit. Also implement the full adder using two half adders and an OR gate.  5

  (b) What is a difference amplifier ? Derive an output voltage expression for the difference amplifier.  5

8. Write short notes on any **two** of the following :  5×2

  (a) Working principle of CRT display

  (b) Function generator

  (c) Clipper and Clamper

  (d) Instrumentation amplifier.