# DECEMBER 2006

**Code: C-03 / T-03**          **Subject: BASIC ELECTRONICS & DIGITAL CIRCUITS**
**Time: 3 Hours**                                                    **Max. Marks: 100**

**NOTE: There are 9 Questions in all.**
- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

**Q.1 A.  Choose the correct or best alternative in the following:**          **(2x10)**

    a.   When a reverse bias is applied to a junction diode, it

        **(A)**  lowers the potential barrier.
        **(B)**  increases the potential barrier.
        **(C)**  greatly increases the minority-carrier current.
        **(D)**  greatly increases the majority-carrier current.

    b.   Hall effect was discovered by Hall in

        **(A)** 1800          **(B)**  1820
        **(C)** 1874          **(D)**  1890

    c.   In a CB configuration the output characteristics of the transistor will be described by the plots of

        **(A)**  $v_{CB}$ versus $i_B$ for constant $I_E$.

        **(B)**  $v_{CB}$ versus $i_C$ for constant $I_E$.

        **(C)**  $v_{CE}$ versus $i_E$ for constant $I_B$.

        **(D)**  $v_{CE}$ versus $i_C$ for constant $I_B$.

    d.   The CE amplifier, when compared to a CB amplifier, has

        **(A)**  lower input resistance.          **(B)**  higher output resistance.
        **(C)**  lower current amplification.          **(D)**  higher current amplification.

    e.   The emitter resistor $R_E$ when bypassed by a capacitor

        **(A)**  reduces the voltage gain.          **(B)**  increases the voltage gain.
        **(C)**  causes thermal runaway.          **(D)**  stabilises the 'Q' point.

    f.   The binary stream 100110010 in hexa-decimal system is

(A) $(132)_8$                  (B) $(132)_{16}$

(C) $(120)_{16}$             (D) $(150)_{16}$

g. The simplified expression for the function $\left(A + \overline{B}C\right)\left(\overline{A}B + C\right)$ is

(A) $A\overline{C} + B\overline{C}$             (B) $\overline{A}\,\overline{C}$

(C) $AC + \overline{B}C$             (D) $\overline{A} + \overline{B}$

h. For high speed TTL, propagation delay in nanoseconds is, approximately

(A) 10                   (B) 8

(C) 6                    (D) 15

i. The number of flip-flops required for a counter that will count 0 to $255_{10}$ is

(A) Four               (B) Six

(C) Eight              (D) Sixteen

j. Karnaugh map simplifies Boolean functions based on the following Boolean identity

(A) $A.1 = A$            (B) $A + \overline{A} = 1$

(C) $A + 0 = A$          (D) $A + 1 = 1$

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**Answer any FIVE Questions out of EIGHT Questions.**
**Each question carries 16 marks.**

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**Q.2** a. What is an extrinsic semiconductor? Name the different types of extrinsic semiconductors. What is Hall effect and what is its use in semiconductors?
**(7)**

b. A sinusoidal signal is applied to a diode circuit shown to get the output as indicated. Draw two circuits which use a single diode and which generates the same output waveform.
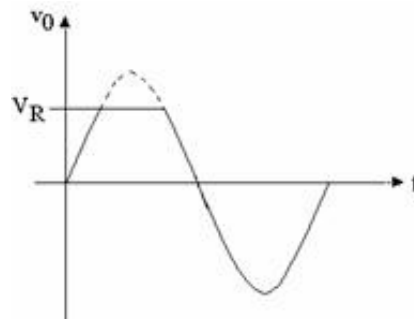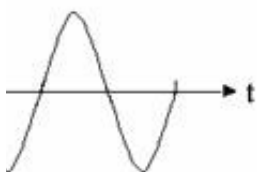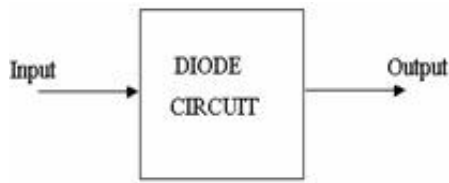
Assume that the Peak of the input voltage is greater than $V_R$.                        **(4)**

  c.  What is a Bipolar junction transistor?  Write the circuit symbol of a bipolar junction transistor. Briefly explain the output characteristics of a CE configuration.                                    **(5)**

**Q.3**  a.  What are the important parameters of an amplifier?  Define each one of them.  Draw the hybrid-model of a CB amplifier and define the various hybrid parameters of the model.
**(11)**

  b.  Write a brief note on Darlington pair.  **(5)**

**Q.4**  a.  Write the importance of source, Drain, Gate and Chanel in a JFET.                        **(7)**

  b.  What is a crystal oscillator?  For what applications do you recommend crystal oscillators?  Draw the circuit of a pierce crystal oscillator using FET and mention its features.                                    **(9)**

**Q.5**  a.  A center-tapped fullwave rectifier circuit uses a transformer having a turns ratio of 0.2 and employs a load of 100 ohms.  If the circuit is driven by a single phase 230V, 50Hz power supply, calculate
     (i)     the d.c. output voltage
     (ii)    the PIV of the diodes and
     (iii)   the rectification efficiency.
Assume the diodes to be ideal.                                    **(6)**

  b.  Draw the circuit of a basic differentiator using an OPAMP and explain its operation.
**(5)**

  c.  What do you mean by a regulated power supply?  What are the important elements of a regulated power supply?  Define the term voltage regulation.                                    **(5)**

**Q.6**  a.  Express the Boolean function, $F = XY + X'Z$ in a product of sums form.        **(5)**

  b.  Simplify the Boolean function $F(w,x,y,z)$ using K-Map.
$F(w,x,y,z) = \sum (0,1,2,4,5,6,8,9,12,13,14)$                        **(4)**

  c.  What is a ROM?  What is its advantage?  Write the block diagram of a ROM and briefly explain.                                    **(7)**

**Q.7**    a.    A Bipolar junction transistor in common emitter configuration is biased at a quiescent collector current $(I_c)$ of 1 mA.  It is known that the transistor will just enter saturation region if the collector current becomes 1.617 mA.  Determine the change in $V_{BE}$ of the transistor from its quiescent value such that it just enters saturation.

**(8)**

   b.    What is a Schottky diode?  What are its advantages?  Draw the circuit of a CMOS NOR gate and briefly explain.                                           **(8)**

**Q.8**    a.    Draw the circuit of a TTL NAND gate with totem pole output and briefly explain.          **(8)**

   b.    Write a note on EPROM.                                                                **(8)**

**Q.9**    a.    What do you mean by 'clocked sequential circuits'?  Draw the circuit of a clocked D flip-flop that       uses        only        NAND        gates        and        briefly        explain        its working.                                                      **(8)**

   b.    What is a synchronous binary counter?  Draw the schematic of a 4-bit synchronous binary counter        using        JK        flip-flops        and        briefly        explain        its        operation.

**(8)**