Code: AC03/AT DECEMBER 2008 **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 Choose the correct or best alternative in the following: (2x10)

a. The mobility of electrons in an N-type semiconductor is $100\times10^{-4}\ m^2/volt-\sec$. If the resistivity of the semiconductor is $20\times10^{-2} ohm-m$, then the number of electron carriers per m^3 will be,

(A) $3.1\times10^{21}/m^3$. **(B)** $2.29\times10^{21}/m^3$.

(C) $1.82\times10^{21}/m^3$. **(D)** $3.82\times10^{21}/m^3$.

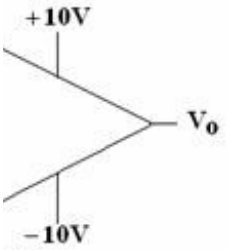

Fig.1

b. The output of comparactor is

(A) –2 V
(B) –5 V
(C) +10 V
(D) –10 V

c. Which of the following h-parameters of a transistor has the greatest value

(A) h_i **(B)** h_r

(C) h_f **(D)** h_o

d. If the value of β for the two transistors used in a Darlington amplifier are 150 and 100 respectively, then the overall current gain of the amplifier is

(A) 14000. **(B)** 12000.

(C) 15000. **(D)** 1000.

e. The parameters of a JFET used in a common source amplifier are : $g_m = 2.5mA/V$ and $r_d = 500K\Omega$. If the value of the load in the drain circuit is $10K\Omega$, then the voltage gain for the amplifier is

(A) –14.5. **(B)** 52.5.
(C) –100. **(D)** –24.5.

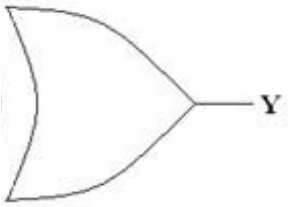

Fig.2

f. The output Y of Logic circuit is
(A) 0
(B) 1
(C) A
(D) $\overline{\mathrm{A}}$

g. The complement of the Boolean expression $\overline{A}B + C\overline{D}$ is

(A) A+BC **(B)** $B + \overline{A}$
(C) $(\mathrm{A} + \overline{\mathrm{B}})(\overline{\mathrm{C}} + \mathrm{D})$ **(D)** 1

h. When $(1010)_2$ is subtracted from $(1000)_2$ using 2's complement method, the result is

(A) $(1110)_2$. **(B)** $(0100)_2$.
(C) $(0010)_2$. **(D)** $(0111)_2$.

i. The fastest Logic family is

(A) TTL **(B)** CMOS
(C) ECL **(D)** HTL

j. How many address bits are needed to operate a $2K \times 8$ - bit ROM memory?

(A) 8 **(B)** 15
(C) 32 **(D)** 11

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

Q.2 a. What is a semiconductor? How does a semiconductor behave at absolute zero temperature? Name four semiconductor materials. **(6)**

b. Design a 4-bit serial-in parallel out Left shift Register. **(5)**

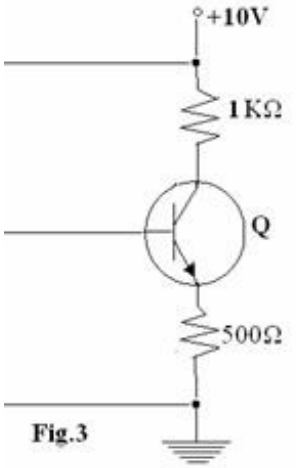

Fig.3

the value of the collector
l collector-to-emitter voltage
age divider of biasing
sistor shown in Fig.3.
Take $V_{BE} = 0.7V$ and $\beta = 100$ for the transistor used. **(5)**

Q.3 a. Describe the advantages of h-parameters? Draw Low frequency small signal hybrid-model for a common emitter transistor and determine Voltage gain (A_V), Current gain (A_I), Input Impedance (Z_i) and Output Impedance (Z_o).
(12)

b. For the amplifier circuit shown in Fig.4, write the h-parameter equivalent circuit and find the current gain for the amplifier. The transistor h-parameters are: $h_i = 22\Omega, h_f = -0.98,$ $h_o = 0.49\mu A/V, h_r = 2.9\times10^{-4}$

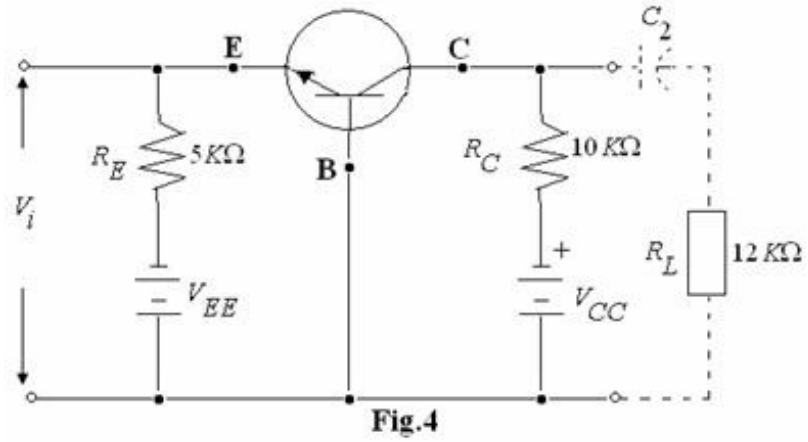

Fig.4

Q.4 a. Draw the a.c. equivalent circuit of a JFET common-drain amplifier and derive the voltage gain of the amplifier. **(8)**

b. Draw the circuit diagram of RC phase oscillator and derive the condition for oscillation. Neglect the effects of h_{re} and h_{oe}. **(8)**

Q.5 a. Draw the circuit of basic Integrator and differentiator using an op-Amp and explain its operation. **(6)**

b. Calculate the output voltage for the circuit given in Fig.5. The input voltages are $V_1 = 50\sin(1000t)mV$ and $V_2 = 10\sin(3000t)mV$. **(5)**

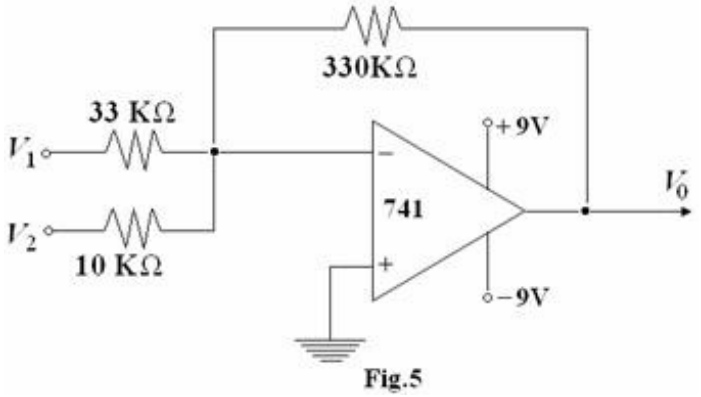

Fig.5

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. Prove the following: $(A+B)(\overline{A}\,\overline{C}+C)\overline{(\overline{B}+AC)} = \overline{A}B$. **(5)**

b. Minimize the Boolean expression given using K-map method.
$f(A,B,C,D) = \Pi(0,1,4,5,6,8,9,12,13,14)$ **(6)**

c. Write the truth table and logic diagram of 1:8 demultiplexer; using NAND gates only. **(5)**

Q.7 a. What is a Schottky diode? Comment on the storage time of Schottky diodes. **(6)**

b. Explain NMOS logic circuit? Draw the circuit of an NMOS inverter that uses an n-channel enhancement-type MOSFET as a load resistor and briefly explain its operation. **(10)**

Q.8 a. What is ECL? Mention its characteristics. **(8)**

b. Write a note on programmable logic arrays. **(8)**

Q.9 a. Draw a static CMOS memory cell and explain it's read and write operations. **(6)**

b. What do you mean by 'STATE' of a counter? Draw the schematic of a four-bit synchronous binary UP-Counter using T flip-flops (positive edge triggered) and briefly explain it. **(10)**

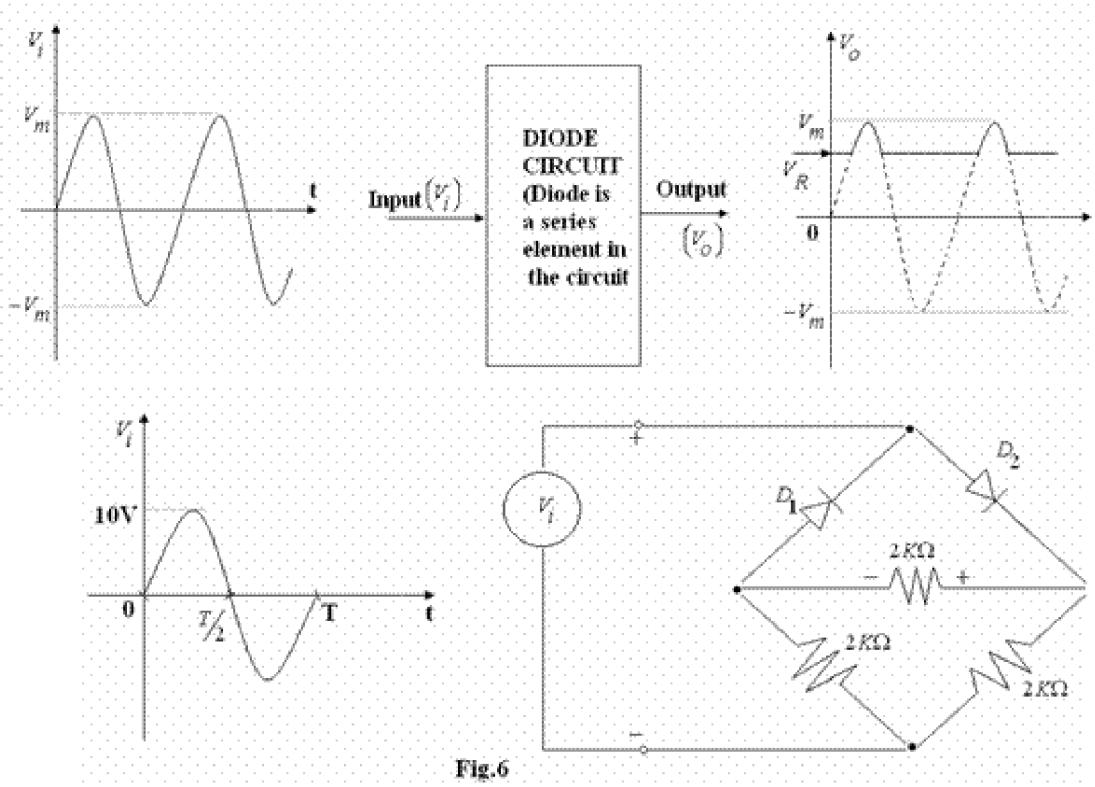
V_i
V_m
$-V_m$
t
Input (V_i)
DIODE CIRCUIT (Diode is a series element in the circuit
Output (V_o)
V_o
V_m
V_R
0
$-V_m$
V_i
10V
0
T/2
T
t
V_i
+
−
D_1
D_2
2KΩ
2KΩ
2KΩ

Fig.6