Total number of printed pages – 8

B. Tech

BENG 1105

First Semester Examination – 2007

BASIC ELECTRONICS

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any ***five*** *from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Distinguish metals from semiconductors with reference to position of Fermi level.

   (b) What is Zener Breakdown ? Give two reasons.

(c) Derive the expression of I_C versus I_B for a CE transistor configuration.

(d) Convert $(0.275)_{10}$ into binary equivalent and $(100101)_2$ into decimal equivalent.

(e) Derive the expression for amplification factor μ of FET.

(f) Draw the circuit of an OPAMP integrator.

(g) Write two disadvantages of positive feedback.

(h) Give two reasons of using modulation.

(i) Draw frequency response of a practical operational amplifier.

(j) Define modulus of an n-bit counter. What is the modulus of a decade counter ?

2. (a) Name a p-n diode that is used in tuned circuits. Explain its operation. 2

(b) Draw the circuit of a double ended clipper using ideal p-n diodes which limits the outputs from +3 Volt to – 3 Volt for sinusoidal input of amplitude 5 Volt. 3

(c) Draw output waveform V_o for the biased clamping circuit shown in Fig. 1. Assume V_i = 5V square wave. What happens to the output waveform when the diode is reversed ? 5

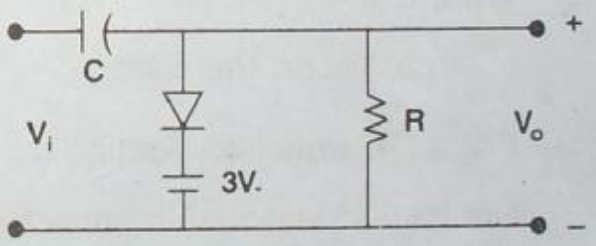

Fig. 1

3. (a) In the circuit shown in Fig. 2, find the minimum value of R_x for which the transistor remains in saturation. Assume that a silicon transistor with $V_{BE,\,sat} = 0.8$ volt, $\beta = h_{FE} = 100$ and $V_{CE,\,sat} = 0.2$ V is used in the circuit. 5

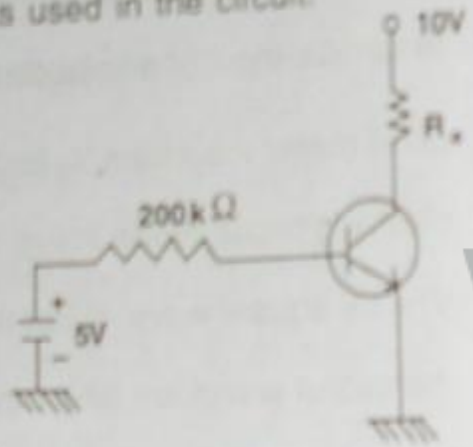

Fig. 2

(b) What is the collector current relative to I_{CO} in a silicon transistor ? 2

(c) For a CE transistor, define h_{FE} and h_{fe}. Derive the relationship between h_{FE} and h_{fe}. 3

4. (a) For the circuit shown in Fig. 3, find the collector current I_C. Assume that a silicon transistor with $h_{fe} = 98$ is used. 5

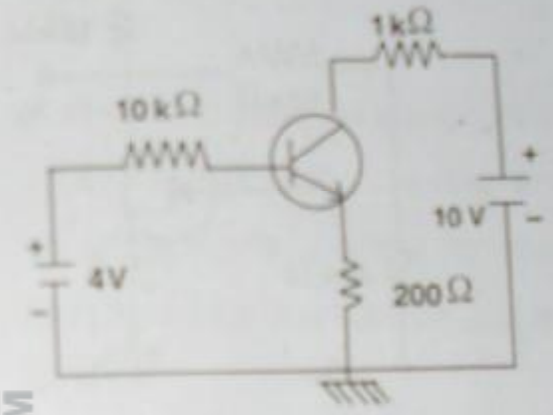

Fig. 3

(b) Describe the principle of operation of enhancement type MOSFET with suitable diagrams. Sketch its transfer characteristics. 5

5. (a) Calculate the voltage gain of the circuit shown in Fig. 4, if the input is given

between gate and ground. The FET parameters are $\mu = 30$ and $r_d = 5$ K ohms. 5

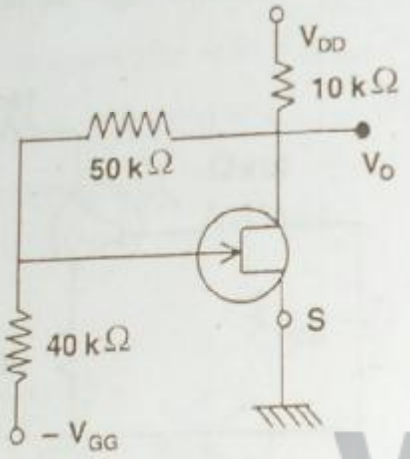

Fig. 4

(b) The gain of an amplifier changes from a value of – 800 by 10%. Calculate the gain change of the amplifier used in a feed back circuit with $\beta = -\frac{1}{20}$. 5

6. (a) Sketch the circuit diagram of a modulo 10 counter. Explain the operation. 5

(b) Using Boolean algebra, verify

$\overline{AB + BC + CA} = \bar{A}\,\bar{B} + \bar{B}\,\bar{C} + \bar{C}\,\bar{A}$ 2

(c) Implement EXOR logic using NOR gates only. 3

7. (a) Draw the schematic block diagram of the basic OPAMP with inverting and non inverting inputs. Indicate its equivalent circuit. List six characteristics of an ideal OPAMP. 5

(b) Sketch the output of a differentiator circuit using an OPAMP, if the input is a square wave of 10 MHz. Assume the time constant of the circuit to be 1 milli seconds. 5

8. (a) Derive the relationship between the output power of an AM transmitter and the depth of modulation, and plot this as

a graph for values of the modulation index from zero to maximum. A suppressed zero graph is misleading in this instance, and must not be used. 5

(b) A certain transmitter radiates 9 kW with the carrier unmodulated, and 10.125 kW when the carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave, corresponding to 40% modulation is transmitted simultaneously, determine the total radiated power. 5

8.1.08