

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-III Examination May 2012

Subject code: 131101

Subject Name: Basic Electronics

Date: 11/05/2012

Time: 02.30 pm – 05.00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1

- (a) Define the following terms: [7]
- | | |
|-----------------------------------|----------------------------------|
| (i) Potential | (ii) ev unit of energy |
| (iii) Volt-equivalent temperature | (iv) Thermal resistance |
| (v) Intermodulation distortion | (vi) Mean life time of a carrier |
| (vii) Peak Inverse Voltage | |
- (b) Draw and explain the transistor current components when it is biased in active region. Obtain the generalized transistor equation. [5]
- (c) In n-type semiconductor, concentration of donor atoms is 4.14×10^{14} atoms/cm³. Calculate the conductivity and resistivity of semiconductor. (Assume: mobility of electron = 3800 cm²/volt.sec) [2]

Q.2

- (a) Explain the Hall effect and obtain the expression of Hall coefficient. List the applications of Hall effect. [5]
- (b) Explain the concept of potential barrier and state Bohr's postulates. [5]
- (c) Draw the circuit of sampling gate and explain its operation. [4]

OR

- (c) A germanium diode has a contact potential of 0.2v, while the concentration of acceptor impurity atoms is 3×10^{20} per m³, calculate for a reverse bias of 0.1v, the width of the depletion region. If the reverse bias is increased to 10v, calculate the new width of the depletion region. Assuming cross-sectional area of the junction as 1mm², calculate the transition capacitance values for both cases. Assume E_r as 16 for germanium. [4]

Q.3

- (a) Draw circuit of CB transistor and explain its input and output characteristics. [5]
- (b) Figure No. 1 shows the two way clipper. If the input voltage is sinusoidal source of 16v peak-to-peak, sketch the output waveform. (Assume voltage drop across diodes is 0.7v) [5]
- (c) Sketch the full-wave rectifier circuit and explain its operation. [4]

OR

Q.3

- (a) Verify mathematically that transistor means “transfer resistor”. Explain the working of phototransistor. [5]
- (b) Figure No. 2 shows an n-p-n transistor. It has the $I_{co} = 2 \times 10^{-5} \text{mA}$ and $\beta = 100$. Find the transistor currents and value of α of transistor. [5]
- (c) Distinguish: (i) avalanche breakdown and Zener breakdown. [4]
(ii) Drift current and diffusion current.

Q.4

- (a) Draw the self-bias circuit and explain how it establishes the stable operating point. [5]
- (b) Draw push-pull arrangement of two transistors and prove that this arrangement can balance out all even harmonics. [5]
- (c) Define thermal runaway. Derive necessary condition to avoid thermal runaway. [4]

OR

Q.4

- (a) Explain the operation of class A large signal amplifier with circuits and output waveforms and also derive the expression of output power. [5]
- (b) Check the condition to avoid the thermal runaway of a self bias circuit, if $V_{cc} = 30\text{V}$, $R_c = 2.0\text{K}\Omega$, $R_e = 4.7\text{K}\Omega$ and collector current $I_c = 1.5\text{mA}$ and give the comments. (Assume that collector current increases by 0.131mA over temperature range of 25 to 75°C). [5]
- (c) Draw and explain regulated power supply system. [4]

Q.5

- (a) Draw following circuits:
(i) Small-signal high frequency equivalent common drain FET amplifier. [6]
(ii) Ebers-Moll model of P-N-P transistor.
- (b) Explain the working and characteristics of p-channel enhancement type MOSFET. [5]
- (c) Datasheet for a JFET indicates that $I_{DSS} = 10\text{mA}$ and $V_{GS(off)} = -4\text{V}$. Determine the drain current for $V_{GS} = 0\text{V}$, -1V . [3]

OR

Q.5

- (a) Draw a transistor amplifier circuit using h parameter and derive expressions for current gain, voltage gain, input impedance and output impedance. [6]
- (b) Consider a single stage CE amplifier (Figure No. 3) with $R_s = 1\text{K}\Omega$, $R_1 = 50\text{K}\Omega$, $R_2 = 2\text{K}\Omega$, $R_c = 1\text{K}\Omega$, $R_L = 1.2\text{K}\Omega$, $h_{fe} = 50$, $h_{ie} = 1.1\text{K}\Omega$, $h_{oe} = 25 \mu\text{A/V}$ and $h_{re} = 2.5 \times 10^{-4}$. Find current gain, input resistance, voltage gain and output resistance. [5]
- (c) Draw the circuit of emitter follower. [3]

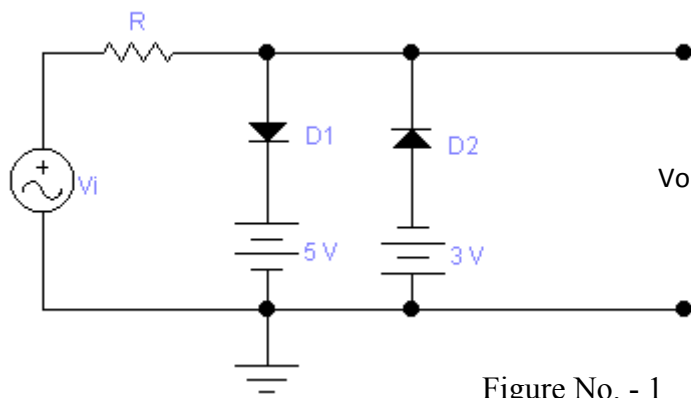


Figure No. - 1

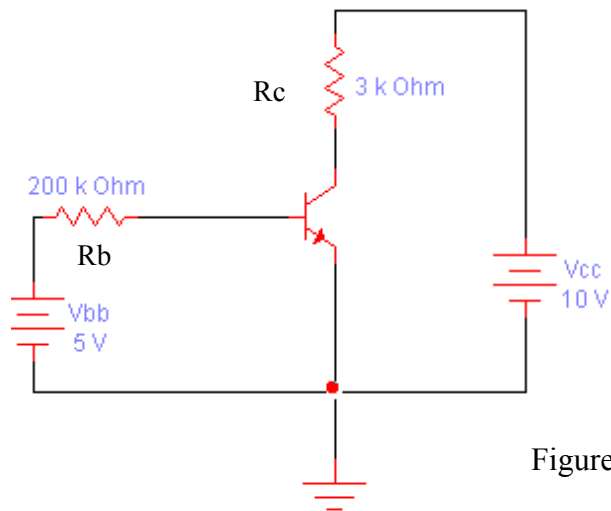


Figure No. - 2

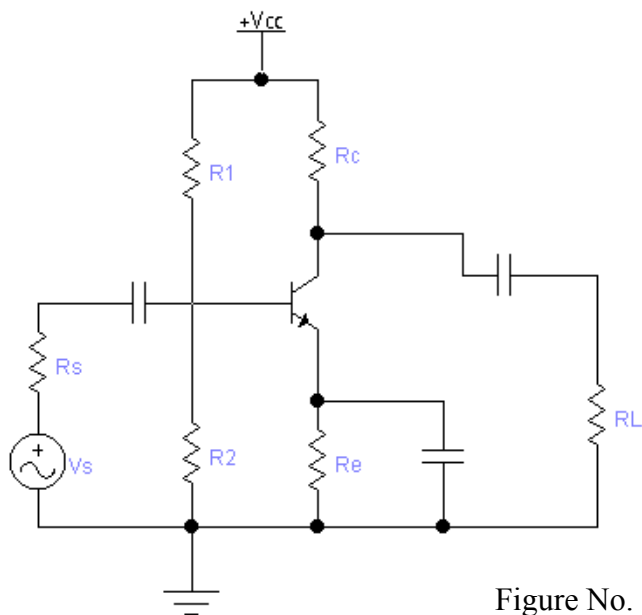


Figure No. - 3