CO-1 Basic Electronics (EC-1000)

(Try to represent your answer pointwise with proper labeling & pictorials & mathematical expressions)

- Classification of Materials
  - Metal (Conductor)
  - (Semiconductor)
  - Insulator
- Properties of Materials
  - Based on Conductivity & Resistivity
    $$\rho = \frac{1}{\sigma}$$
  - Based on Energy Band
- Energy Band of Semiconductor
  - Valance Band
  - Conduction Band
  - Forbiden Energy Gap
- Classification of Semiconductors
  - Intrinsic (Pure)
  - Extrinsic (Impure)
    - N-Type
    - P-Type
- Different Types of Semiconductor
  - Basic
  - Compound
  - Alloys
- Doping Process — Dopant
  - Trivalant
  - Pentavalant.

Why doping?

What happen to Fermi level in Energy Band diagram?

- Crystaline structure of N-Type & P-Type Semiconductor.
- Concept of Drift & Diffusion Current.
- Understanding of Terms —
  - Donore
  - Dopant
  - Acceptore
  - Imobile Ions
  - Majority & Minority Carriers.
  - Electron & Hole Current.
  - Breakdown of Covalant Bond
  - Recombination Procees
- Maes action low — $\boxed{n \cdot p = n_i^2}$ (Numerical)
- Comparisson bet^n Basic Semiconductor.

Silicon (Si)	Germanium (Ge

- Sample Numerical
  (a) In an extrinsic semiconductor concentration of holes is $5.2 \times 10^{10} cm^{-3}$. Calculate concentration of electrons. Intrinsic concentration = $2.3 \times 10^{13} cm^{-3}$ at 300K.
- Effect of Temperature on the resistance of a conductor and semiconductor.

CO-2 Basic Electronics (EC-10001)

- P-N Junction Diode & its operation
- What is Biasing
  - Forward
  - Reverse
- Characteristics of Crystal & Zener Diode with its Terms —
  - V-I characteristics (FB & RB)
  - V_{knee}
  - Breakdown Voltage
  - Reverse saturation Current.
  - PIV or PRV of a Diode
- Ideal Diode & Equivalent ckt. of practical Diode.
- Diode Equation.

$$I_D = I_S \left(e^{(kV_D)/T_K} - 1\right)$$

(Define all parameters) (Numerical)

- Diode Resistance
  - Static (DC)
  - Dynamic (AC)
- Breakdown in Reverse Bias
  - Avalanche
  - Zener
- Sample Problem

The reverse saturation current at 300K of a p-n junction Ge diode is 5μA. Find the voltage to applied across the junction to obtain a forward current of 50mA.

- Application of Diode
  - Rectification using crystal diode
    - Half wave
    - Full wave (Only Centertap)
  - Voltage Regulation using zener diode

(Ckt. diagram & Operation)

- Performance of Rectifier with its expression & calculation.

(HW)

- $I_{DC} = \frac{I_m}{\pi}$
- $V_{DC} = \frac{V_m}{\pi}$
- P_{DC} & P_{AC} for Efficiency $\eta = 40.6\%$
- PIV or PRV of Halfwave Rectifier $\geq V_m$
- Ripple factor $\gamma = 1.211$

- $I_{DC} = \frac{2I_m}{\pi}$
- $V_{DC} = \frac{2V_m}{\pi}$
- ~~PRV~~ Efficiency, $\eta = 81.2\%$
- Ripple Factor $\gamma = 0.48$
- PIV of Full wave Rectifier $\geq 2V_m$

- Advantage & Disadvantage of HW & FW Rectifier.
- Different Input & output waveforms of Rectification Process.
- Rectifier output with different Filter (C, LC) and its waveform representation.

- Sample Problem
  - A diode, the forward resistance is 50ohm, supplies power to a load resistance 1200ohm from a 20V (rms) source. Calculate (i) the dc load current (ii) the dc voltage across the diode (iii) the ac load current (iv) the dc output power (v) the conversion efficiency and (vi) the percentage regulation.

  - A center tap. full wave rectifier has load resistance of 5kΩ and input voltage is $150 \sin(120\pi t)$ V. Determine (i) peak, average and rms value of load current (ii) dc output voltage (iii) PIV of each diode (iv) efficiency (v) output efficiency. (Assume diodes to be ideal diode).

** Do not try to simply answer the questions only

** Try to properly present your answer connectly.

- Bipolar Junction Transistor

- Doping level of Emitter, Base & collector
- ~~General~~
- Operation of BJT through proper Biasing arrangement.
- Fundamental current Eqn

$$I_E = I_C + I_B$$

- Different Configuration

CE: Gain $= \beta = \frac{I_C}{I_B}$ CB: Gain $= \alpha = \frac{I_C}{I_E}$ CC: Gain $= \gamma = \frac{I_E}{I_B}$

Relation between α, β, γ.

- Leakage Current

I_{CBO} & I_{CEO}

- Current Relations

$$I_C = \alpha I_E + I_{CBO}$$
$$I_B = (1-\alpha) I_E - I_{CBO}$$
$$I_C = \beta I_B + (1+\beta) I_{CBO}$$
$$I_C = \beta I_B + I_{CEO}$$

- Sample Problem

1.- If $\beta = 16.5$, $I_E = 1.8\,mA$ and $I_{CO} = 12\,\mu A$, Calculate I_C and I_B when transistor used in the CE configuration.

2.- If $\alpha = 0.95$, then find β of the transistor.