0 6 NOV 2015

Time: 01 hour

Answer **ALL** Questions

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Q1.

a) Distinguish intrinsic and extrinsic semiconductors.
Explain with the aid of suitable diagrams (including energy band diagram) the two types of extrinsic semiconductors.

b) A narrow silicon bar having a circular cross section area measuring 1 mm diameter is doped with $10^{18}$ acceptors/cm$^3$. If the hole mobility in silicon is 1800 cm$^2$V$^{-1}$s$^{-1}$ at 300 K and electron charge is $e = 1.6 \times 10^{-19}$C. Calculate the resistivity of the doped silicon and the length of the bar to provide a total resistance of 700Ω. You may assume that at room temperature all impurities are ionized and that the concentration of intrinsic carriers is negligible.
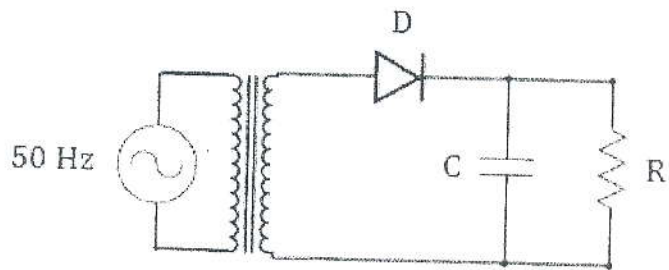
Prove any formula you may use.

Q2.

a) Explain the depletion region and barrier potential of a P-N junction.

b) Sketch and explain the forward and reverse characteristic of a P-N junction diode.

c) For the circuit shown below, the rms value of the input voltage to prim coil of the transformer is 230 V. The output of this circuit is connected load resistance of 10 kΩ through a capacitor filter of 100 µF. The diode ideal.



The total power of the load resistance is 4.05 W. Calculate the following
i. DC component of load voltage,
ii. The peak load voltage,
iii. The turn's ratio of the transformer.

Prove any formula you may use.