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TEC-101

B. Tech. (First Semester)
Mid Semester EXAMINATION, 2017
(All Branches)

BASIC ELECTRONICS ENGINEERING

Time : 1:30 Hours] [Maximum Marks : 50

Note : (i) This question paper contains two Sections.
(ii) Both Sections are compulsory.

Section—A

1. Fill in the blanks/True-False : (1×5=5 Marks)

- (a) When a depletion region of a diode is large the barrier voltage is also large. (True/False)
- (b) The forward voltage drop for a germanium diode is 0.7 V and for a silicon transistor is 0.3 V. (True/False)
- (c) In n type semiconductor added impurity is
- (d) A covalent bond is when atoms lose valence shell electrons. (True/False)
- (e) For germanium the forbidden gap is

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2. Attempt any *five* parts : (3×5=15 Marks)

(Define/Short Numerical/Short Programming/Draw)

- (a) Explain Mass Action law.
- (b) Why are GaAs devices used in high speed applications ? Explain.
- (c) What is meant by doping ? How does it affect a semiconductor ?
- (d) For the function, $F(A, B, C) = \Sigma (1, 5, 7)$, write the canonical POS and SOP expressions.
- (e) Convert the following bases :
 $(724)_8 = (\dots\dots\dots)_2 = (\dots\dots\dots)_{16}$
- (f) Add the following hexadecimal numbers :

$$(37F3A)_H \text{ and } (23C1D)_H$$

Section—B

3. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

- (a) With the help of energy bands explain how conduction takes place in conductors, semiconductors and insulators.
- (b) A half-wave rectifier has a load resistance of 1 k Ω . If the diode and secondary of the transformer have a total resistance of 50 Ω

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and the a. c. input voltage has 240 V, the turn ratio of the transformer is 4 : 1. Determine :

- (i) Peak, RMS and Average values of current through load.
- (ii) D.C. power output.
- (iii) A.C. power input.
- (iv) Rectification Efficiency.
- (c) For the logic expression $Z = AB + AC$:
 - (i) Obtain the truth table.
 - (ii) Name the operational performed
 - (iii) Realize this operation using AND, OR, NOT gates.
 - (iv) Realize this operation using NAND gates only.

4. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

- (a) (i) Derive the expression for continuity equation.
- (ii) Explain mobility and conductivity.
- (b) An intrinsic semiconductor (Si) is doped with a donor type impurity such that there is one impurity atom on 10^6 atoms of semiconductor. The total concentration of semiconductor is $5 \times 10^{22}/\text{m}^3$ and intrinsic concentration is $2.5 \times 10^{12}/\text{m}^3$. Calculate :
 - (i) Resulting donor atom concentration.

(ii) Resulting electron concentration.

(iii) Resulting hole concentration

(iv) Conductivity of the doped sample
if mobility of electron is $3800 \text{ m}^2/\text{V-s}$.

(c) Why are filters used along with rectifiers in the construction of a power supply ? List the filter types used in power supplies. Explain their effect on rectifier output waveforms.

5. Attempt any *two* parts of choice from (a), (b) and (c). (5×2=10 Marks)

(a) What is a diode ? With the help of a suitable diagram explain the V-I characteristics of *p-n* junction diode.

(b) (i) Prove the NOR gate is a Universal Gate.

(ii) Simplify the following expression using Boolean algebra technique :

$$Z = AB' + A(B' + C) + B(B + C')$$

(c) With the help of a neat diagram explain the working of a Center Trapped Rectifier and describe its operation.