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TEC-101

B. Tech. (First Semester)

End Semester EXAMINATION, 2017

(All Branches)

BASIC ELECTRONICS ENGINEERING

Time : Three Hours] [Maximum Marks : 100

Note : (i) This question paper contains *five* questions.

(ii) All questions are compulsory.

(iii) Instructions on how to attempt a question are mentioned against it.

(iv) Total marks assigned to each question are **twenty**.

1. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Discuss the laws of Boolean algebra.

(b) Realize AND, OR, NOT, XOR, XNOR gates using NOR gates only.

(c) Perform the following operations :

(i) $(97)_{10} + (85)_{10}$ in BCD system.

(ii) $(542)_{10} - (876)_{10}$ in BCD system using 9's complement.

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2. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)
- (a) Distinguish between the following :
- Insulators, semiconductors and conductors
 - P type and N type semiconductors
- (b) Define the following with mathematical expressions :
- Mass action law
 - Mobility
 - Conductivity
- (c) Consider an intrinsic semiconductor with intrinsic concentration of $1.5 \times 10^{10}/\text{cm}^3$ at room temperature. Determine its conductivity. Now if a donor type impurity with concentration of $8 \times 10^{15} \text{ atoms}/\text{cm}^3$ is added to it, what will be the concentration of majority and minority carries ? Also find the conductivity of this extrinsic semiconductor. (Given : Mobility of electrons = $1300 \text{ cm}^2/\text{V-sec}$ and Mobility of holes = $500 \text{ cm}^2/\text{V-sec}$).
3. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)
- (a) Discuss V-I characteristics of a P-N junction diode. Compare the V-I characteristics of Germanium and Silicon diodes.

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- (b) Discuss the working of a Bridge rectifier with neat circuit diagram. Also determine its maximum rectification efficiency and ripple factor.
- (c) Draw a neat voltage regulator circuit using Zener diode. Now, in this circuit, assume that series resistance $R_s = 1 \text{ k}\Omega$, input voltage $V_i = 16 \text{ V}$, Zener breakdown voltage $V_Z = 10 \text{ V}$ and load resistance $R_L = 3 \text{ k}\Omega$. Determine load voltage V_o , load current I_L and current through Zener diode I_Z .
4. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)
- (a) Discuss Voltage divider bias circuit of BJT with mathematical analysis.
- (b) Explain construction, operation and characteristics of E-MOSFET.
- (c) (i) Find the relation between α and β parameters of a BJT.
(ii) For a BJT, determine emitter current, α and β for collector current = 0.1 mA and base current = $30 \mu\text{A}$.
5. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)
- (a) What is an operational amplifier (op-amp.) ? Discuss its open loop gain and CMRR.

- (b) Draw and discuss the op-amp. based integrator and differentiator circuits.
- (c) Derive the mathematical expression for the output voltage of the following op-amp. based circuits :
 - (i) Adder
 - (ii) Subtractor