

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
2015/2016 RAIN SEMESTER EXAMINATION

ENG 226: INTRODUCTION TO ELECTRICAL AND ELECTRONIC ENGINEERING

INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER FOUR QUESTIONS TIME: 3 HOURS

- 1a Briefly explain the concept of transient and its period as applied to electrical signal
- b With respect to five different applications of transient, explain its relevance to you
- c State the three fundamental formulas used in the analysis of transients.
- d With a relevant sketch, explain the phenomenon of transients as applied to capacitor charging. Give one similar real-life example of this process that is utilized in automobile industry.
- 2a Derive the transformation ratio of the transformer
- bi Why is the equivalent circuit of a transformer necessary?
- ii What are the quantities to be modeled in a transformer?
- iii Mention the 3 elements that make up the equivalent circuit. How are they used to model the quantities in (ii) above?
- iv Draw the practical transformer equivalent circuit with losses.
- 3a Why is the transformer test necessary and what do you use the test for?
- b With appropriate diagrams, discuss the following tests and identify parameters to be obtained from them
- i Open circuit test (ii) Short circuit test
- ci Using appropriate diagrams and equations show the difference between a motor and a generator
- ii With appropriate diagrams, show 3 types of DC generators
- 4 What is the distance of separation between two electrons in
(a) Vacuum (b) medium with $\epsilon_r = 5$ for which the electric force between them is equal to the gravitational force on one of them at the earth surface? (Mass of electron = $9.1 \times 10^{-31} \text{ Kg}$, Charge of electron = $1.6 \times 10^{-19} \text{ C}$)
- 5 Two batteries A and B are connected in parallel and a load of 8 ohms is connected across their terminals. A has an EMF of 15V and an internal resistance of 3 ohms. B has an emf of 12V and an internal resistance of 2 ohms. Use Kirchhoff's laws to determine the values and directions of the currents flowing in each of the batteries and in the external resistance. Also determine the potential difference across the external resistance.
- 6a Briefly define an IC and mention five (5) advantages it has over connections with discrete components.
- b With a diagram, illustrate an ideal power supply unit and identify its four major stages and their components.
- c A certain amplifier has its $A_p = 5$, $P_{out} = 30\text{W}$ and $I_{in} = 3\text{A}$. Calculate its input voltage
- d An electric circuit with supply voltage of 10v has a silicon diode connected in forward bias with a $20\text{k}\Omega$ resistor. Determine the current flowing through the diode (I_D)
- 7a Write down the truth table, Boolean expression and logic symbol of the following digital logic gates:
AND gate (ii) OR gate(iii) Ex - OR gate
- b Access can only be granted into a certain building with three doors if there are a minimum of two attempts and a maximum of three attempts at the doors. Design a logic circuit that can implement this requirement.