JARAMOGI OGINGA ODINGA UNIVERSITY OF SCENCE AND TECHNOLOGY

SCHOOL OF INFRMATICS AND INNOVATIVE SYSTEMS

COURSE CODE: IIT 3124

COURSE TITLE: ELECTRONIC CIRCUIT AND THEORY

KLC

DECEMBER 2013 TIME 2HRS

INSTRUCTIONS:

i. **This paper contains five (5) questions.**
ii. **Question ONE is Compulsory and any other TWO questions**
iii. **Answer the questions on the booklet provided**

QUESTION ONE (30 MARKS) COMPULSORY

a) Draw energy band diagrams for conductors, insulators and semiconductors. Explain the reasons for the differences between the diagrams (8 Marks)
b) Define the donor doping. Draw a sketch to illustrate and explain the process (6 Marks)
c) A Zener diode with V_z = 4.3V has Z_z equal to 22 ohms when I_z = 20mA. Calculate the upper and lower limits of V_z and I_z changes by +/- 5mA (6 Marks)
d) State Thevenin's theorem, illustrate by use of a diagram (4 Marks)
e) Define the following terms (6 Marks)
    i) Conductance
    ii) Impedance
    iii) Reactance
    iv) Resonace

QUESTION TWO (20 MARKS)

a) A diode with V_F= 0.7V is connected as a half wave rectifier. The load resistance is 500 ohm, and the rms ac input is 22V. Determine the peak output voltage, the peal current, and the diode peak reverse voltage. (6 Marks)
b) Draw the circuit diagram for a DC power supply that uses a bridge rectifier and a capacitor filter circuit. Sketch the input and output waveforms, and explain the circuit operation and the shape of the waveforms. (9 Marks)
c) By use of sketch diagrams, explain the operation of an NPN transistor (5 Marks)

QUESTION THREE (20 MARKS)

a) Identify the components that constitute the dc load in a BJT bias circuit. Explain the procedure for drawing the load line on the transistor CE output characteristics (6 Marks)
b) Draw the three basic bias circuit types namely base bias, collector- to- base bias and voltage divider bias; state the stability factor equation for each of the biasing circuit. (12 Marks)
c) State Kirchhoff's current and voltage laws (2 Marks)

QUESTION FOUR (20 MARKS)

a) State the characteristics of an ideal operational amplifier (4 Marks)
b) Draw a three input summing amplifier circuit diagram using an operational amplifier as a summer for three input voltages v_1, v_2 and v_3. Calculate the output voltage in terms of resistance and voltage. Show your working. (8 Marks)
c) Define Laplace transform of a function f(t). Find the Laplace transforms for the functions $F_1(t) = e^{-at}\sin wt \cdot u(t)$ (8 Marks)

QUESTION FIVE (20 MARKS)

a) A series RLC resonant circuit has a resonant frequency admittance of $2x10^{-2}$ S(mohs). The Q of the circuit is 50, and the resonant frequency is 10,000 rad/sec. Calculate the values of R, L, and C. (6 Marks)

b) For the above circuit (Q5 a), find the half-power frequencies and the bandwidth. (4 Marks)

c) From first principles, prove that in a series circuit for three resistors R_1, R_2, and R_3, the effective resistance (R_{eff}) is given by $R_{eff} = R_1 + R_2 + R_3$ (3 Marks)

d) Given a 10 Vrms and 50 Hz power source hooked up in series to a 0.04 H inductor, a 5 Ω resistor, and 0.01 F capacitor. Calculate the impedance of this circuit and the resonance frequency (7 Marks)

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