



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEM

ACADEMIC YEAR 2013/2014

COURSE CODE: IIT 3124:

COURSE TITLE: CIRCUIT THEORY BASIC ELECTRONIC

PERIOD: MAY- AUG 2013

DURATION: 2 HOURS

Answer Question 1 and any other two Questions

QUESTION ONE (30 MARKS) COMPULSORY)

- a) Define following terms: 06 Marks
- (i) Electron Volt (eV).
 - (ii) Mobility of charge carries.
 - (iii) Barrier potential.
 - (iv) Voltage equivalent of temperature.
- b) Differentiate the following; insulator, semiconductor and conductor in terms of energy band diagram. 06 Marks
- c) State and explain Superposition Theorem. 03 Marks
- d) From first principle prove that the effective resistance R_{eff} for three resistors (R_1 , R_2 , and R_3) connected in parallel and supplied with an emf is given by $R_{\text{eff}} = R_1 R_2 R_3 / (R_1 + R_2 + R_3)$ 05 Marks
- e) Show that for an inverting OPAMP the output voltage $v_o = -(R_f / R_{\text{in}}) v_{\text{in}}$ 06 Marks
- f) Explain the following terms in relation to electronic circuit: 04 Marks
- i) Reactance ii) Impedance iii) Resonance iv) Resistance

QUESTION TWO (20 MARKS)

- a) State the need of biasing. 02 Marks
- b) Discuss voltage divider bias circuit and mention its advantages. 06 Marks
- c) Explain following for npn transistor.
- (i) Current components. 03 Marks
 - (ii) Regions of operation according to biasing condition 03 Marks
- d) Give points of difference between BJT and FET. Also explain FET as voltage variable resistor. 06 Marks

QUESTION THREE (20 MARKS)

- a) Draw a circuit diagram of full wave bridge rectifier and give its input and output waveforms. 07 Marks
- b) Derive the expression for the d.c. current in Q3a) above. 03 Marks
- c) Draw circuit of CC and CB configuration of a transistor. 06 Marks
- d) Compare current gain ,voltage gain ,input impedance and output impedance of both CC & CB 04 Marks

QUESTION FOUR (20 MARKS)

- a) Explain the Laplace Transformation method as used for solving circuit problems. 02 Marks
- b) Derive the Laplace transform for the functions i) $5t$ and ii) $\sin(3t)$ 06 Marks
- c) Design a fixed bias circuit using silicon npn transistor Which has $\beta_{dc} = 150$. The dc biasing point is $V_{CE} = 5V$ And $I_c = 5 \text{ mA}$ Supply voltage is $10V$. 08 Marks
- d) State advantages and disadvantages of fixed bias circuit. 04 Marks

QUESTION FIVE (20 MARKS)

- a) State Kirchhoff's current and voltage Laws 03 Marks
- b) For a 12 V_{rms} and 60 Hz power source hooked up in series to a 0.05 H inductor, $5 \text{ } \Omega$ resistor, and 0.01 F capacitor. Determine the following
 - i) Circuit Impedance (Z) 04 Mark
 - ii) Circuit Resonance frequency (f_o) 03 Marks
 - iii) Phase Angle (ϕ) 02 Marks
- c) Identify three factors affecting the value of capacitance and briefly explain how they do affect the capacitance 03 Marks
- d) Calculate the charge stored on a 3-pF capacitor with $20V$ across it and also find the energy stored in the capacitor 05 Marks