



# **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  $R_{eff} = R_1 R_2 R_3 / (R_1 + R_2 + R_3)$  05 Marks
- e) Show that for an inverting OPAMP the output voltage  $v_o = -(R_f / R_{in}) v_{in}$  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  $12 \text{ V}_{rms}$  and  $60 \text{ Hz}$  power source hooked up in series to a  $0.05 \text{ H}$  inductor,  $5 \text{ } \Omega$  resistor, and  $0.01 \text{ F}$  capacitor. Determine the following
  - i) Circuit Impedance ( $Z$ ) 04 Mark
  - ii) Circuit Resonance frequency ( $f_o$ ) 03 Marks
  - iii) Phase Angle ( $\phi$ ) 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  $3\text{-pF}$  capacitor with  $20V$  across it and also find the energy stored in the capacitor 05 Marks