



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR FIRST TERM EXAMINATION FOR

CERTIFICATE IN ELECTRICAL ENGINEERING

1602/202: ELECTRICAL PRINCIPLES I

DATE: 4/6/2021

TIME: 8.30-11.30 AM

INSTRUCTIONS

Answer all the questions

1.
 - a) Give three differences between the null and the deflection types of measuring instruments (6 marks)
 - b) Explain using a diagram how a null type of an instrument operates (4 marks)
 - c) Explain what a shunt is in electrical principles (4 marks)
 - d) A 20Ω galvanometer with a full scale deflection of 5mA is used to measure a current of 100mA . Calculate the value of the shunt resistance required. (6 marks)
2.
 - a) Define the following an amplitude, period and frequency. (2 marks)
 - b) A sinusoidal waveform is has a period of 0.02sec and a root mean square value of 12V . sketch the wave, show the period and the peak. (4 marks)
 - c) Calculate the peak to peak value, the frequency, and the average value of the wave (4 marks)
 - d) Calculate the current flowing in an inductor of 1.5H and 50Ω when supplied with a 240V source (4 marks)
 - e) An alternating voltage is given by $v=50\sin(100\pi t-0.25)\text{Volts}$. Find
 - i. the amplitude
 - ii. peak to peak value
 - iii. the r.m.s. value
 - iv. the periodic time

- v. the frequency
 - vi. the phase angle. (6 marks)
3. a) i Define dc transients (2 marks)
- ii Name two methods used to determine dc transients (2 marks)
- b) A $4\mu\text{F}$ capacitor is charged to 240V and then is discharged through a $220\text{K}\Omega$ resistor. Using the initial slope and three-point method draw the voltage/time characteristics. From the characteristics determine the value of capacitor voltage after 1.5seconds (16 marks)
4. A relay has an inductance of 100mH and a resistance of 20Ω . It's connected to a 60V D.C supply. Use the initial slope and three-point method to draw the current time characteristics and hence determine the value of current flowing at a time equal to two time constants and the time for current to grow to 1.5A. (20 marks)
5. a) i) In a Wheatstone bridge circuit, calculate the unknown resistor given that $R_1 = 400\Omega$, $R_2 = 200\Omega$ and $R_3 = 600\Omega$ (7 marks)
- b) A 50Ω galvanometer with a full-scale deflection of 100mA is used to measure a current of 10A. Calculate
- i. The value of the shunt resistance needed.
 - ii. If it were to be converted to a voltmeter to measure up to 50V, calculate the required multiplier value needed. (13 marks)