TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

UNIVERSITY EXAMINATION

DIPLOMA IN TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING

EEP 2103: CIRCUIT THEORY I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2019

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of FIVE questions. Answer any **THREE** questions.
All questions carry equal marks (20 marks).
Do not write on the question paper.

QUESTION 1

(a) A capacitor is made up of two rectangular plates 5 cm long and 2.2 cm wide which are separated by a mica sheet 2 mm thick. If for mica $\varepsilon_r = 6$. Find the value of the capacitor. i.e its capacitance. ($\varepsilon_o = 8.85 \times 10^{-12} F/m$) **(6 marks)**

(b) A capacitor C in series with a Resistor R is connected to a d.c voltage V_O via a switch S_1. Describe with the help of well labelled diagram V_C, V_R and I_R varies with time **(10 marks)**

(c) Given that in (b), V_O = 100 V, R = 2 MΩ, C = 5 µF, calculate the voltage across the capacitor 20 seconds after the switch is connected. **(4 marks)**

QUESTION 2

(a) Determine the four band colour code of a resistor whose nominal value is 2 Ω and has a tolerance of ± 10%. Illustrate how you arrive at your answer **(6 marks)**

(b) State maximum power transfer theory. **(3 marks)**

(c) For Fig. Q2, determine the value of R_L which will result in maximum power hence calculate its maximum power given that $E_1 = 9$ V, $E_2 = 2$ V, $R_1 = 3$ kΩ, $R_2 = 6$ kΩ, $R_3 = 1$ kΩ. **(11 marks)**

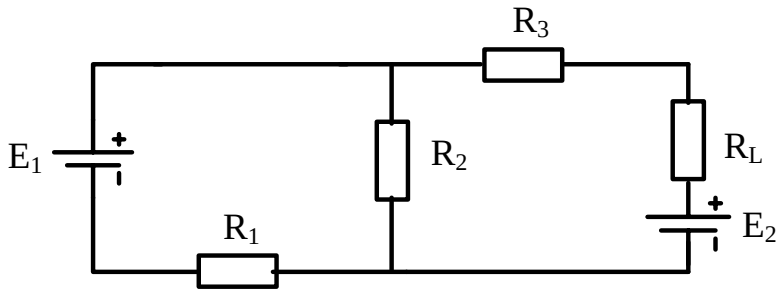

Fig. Q2.

QUESTION 3

(a) State what the following five parameters of magnetic circuits represents: B, ϕ, μ_r, m.m.f, S. **(5 marks)**

(b) Describe two effects of current flow in a conductor and state one practical application of each effect. **(4 marks)**

(c) A magnetic circuit of uniform cross-sectional area (c.s.a) consists of three parts in series. One part is 80 mm long with c.s.a of 50 mm^2, second part 60 mm long with c.s.a of 90 mm^2 and third part an air gap of 0.5 mm with a c.s.a of 150 mm^2. A coil of 4000 turns is wound on the second part and the flux density in the air gap is 0.3 T. Assuming all the flux passes through the circuit and relative permeability of the material is 1300, calculate the coil current to produce such a flux. ($\mu_o = 4\pi \times 10^{-7} H/m$) **(11 marks)**

QUESTION 4

(a) State any THREE factors on which resistance of a material depends. **(4 marks)**

(b) Describe with the help of a suitable diagram and formulae, Macmillan's theorem. **(6 marks)**

(c) Using source transformation method, calculate current through resistor R_2 in Fig.Q4, given that $E_1 = 10$ V, $R_1 = 2$ kΩ, $R_2 = 3$ kΩ, $R_3 = 6$ kΩ. **(10 marks)**

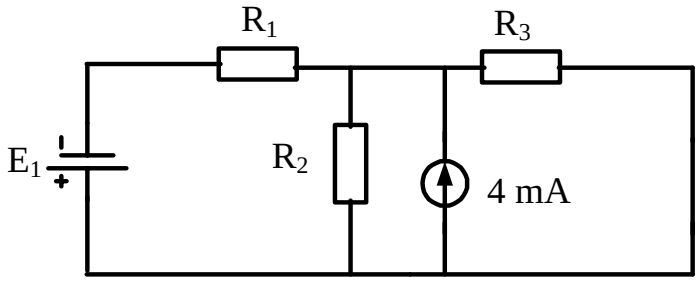

Fig. Q4

QUESTION 5

(a) Differentiate between an ideal and non-ideal d.c voltage source. **(2 marks)**

(b) State superposition theorem. **(4 marks)**

(c) Apply superposition theorem in Fig. Q5 to calculate currents through resistors R_1, R_2 and R_3 given that $E_1 = 10$ V, $E_2 = 20$V, $R_1 = 3$ kΩ, $R_2 = 2$ kΩ, $R_3 = 4$ kΩ. Indicate the direction of current in each branch.

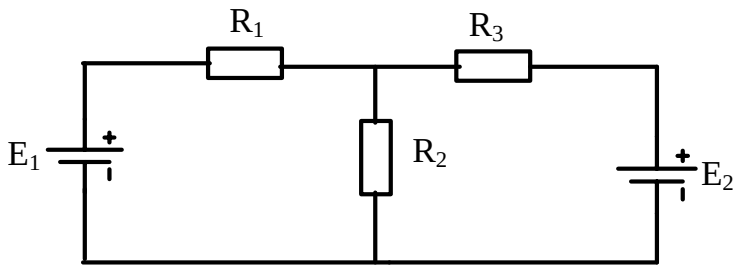

Fig. Q5.

(12 marks)