Candidate seat No: _____

Charotar University of Science and Technology [CHARUSAT]
Faculty of Technology and Engineering

Subject: EE 141 Basics of Electronics and Electrical
First Unit Test-SOLUTION

Semester: 1st SEM B. Tech. (EC/CP/IT/CSE) **Maximum Marks: 30**

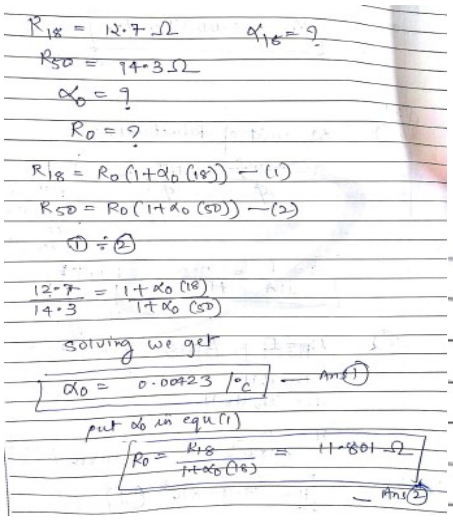
Date: 06/09/2018 (Thursday) **Time: 11:10 am to 12:10 pm**

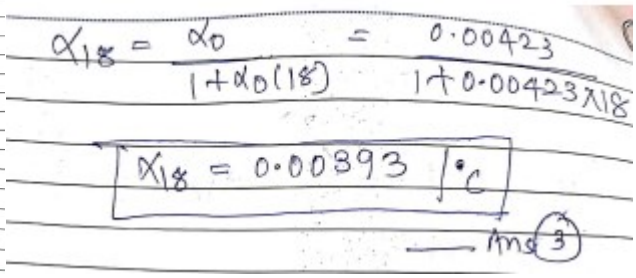
Instructions:

(i) Attempt ***all*** the questions.
(ii) Figures to the right indicate ***full*** marks.
(iii) Make suitable assumptions and draw neat figures wherever if required.

Q-1 Answer the questions below. **[05]**

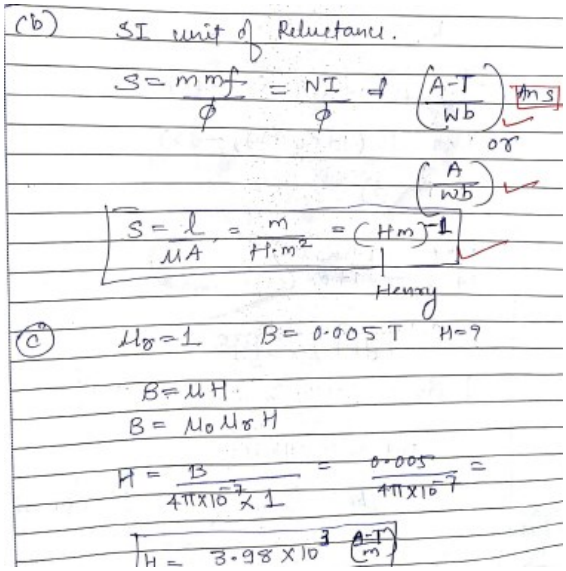
(a) The field winding of a generator has a resistance of 12.7 Ω at 18 ˚C and 14.3 Ω at 50 ˚C. find (i) temperature coefficient at 0 ˚C, (ii) resistance at 0 ˚C, (iii) temperature coefficient at 18 ˚C **[03]**





(b) The SI unit of Reluctance is _____. **[01]**

(c) What is the magnetic field intensity in a material whose relative permeability is 1 when the flux density is 0.005 T? **[01]**

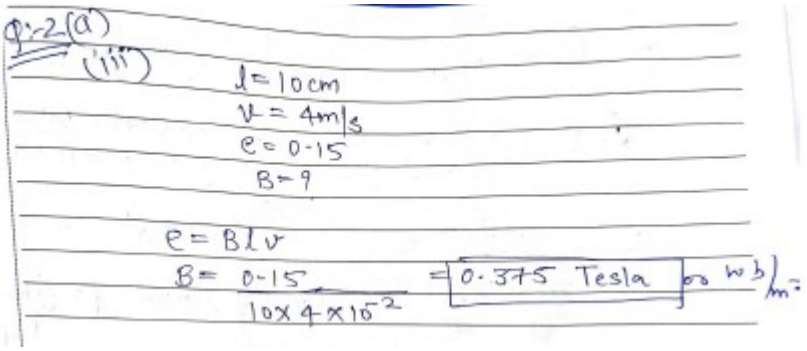


Q-2 Answer the questions below. **[05]**

(a) (i)Define Faraday's second law of electromagnetic induction. **[01]**

(ii)Compare Electric and Magnetic Circuit (Mention at least six points) **[03]**

(iii) A wire 10 cm long is moved at a uniform speed of 4 m/s at a right angle to its length and to a uniform field. Calculate the density of the field if the EMF generated in the wire is 0.15 V. **[01]**



OR

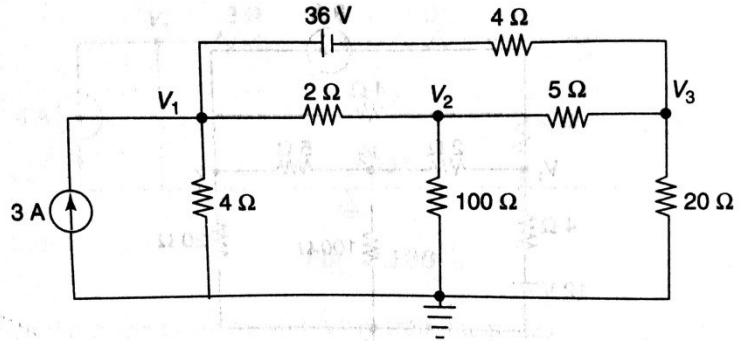
(a) The flux of 1 mWb is produced by coil A when it carries a current of 4 A. Another coil B produces a flux of 1.5 mWb carrying the same current. Coil A has 800 turns and coil B has 1200 turns. The coils are kept such that 80% of flux produced by coil A links with coil B. Calculate **[05]**

i) Self-inductance of each coil
ii) Mutual inductance
iii) Co-efficient of coupling
iv) Percentage of flux produced by coil B that links with coil A

ANS: i)L1= 0.2 H , L2= 0.45 H
ii) M = 0.24 H
iii) K= 0.8
iv) K2= 0.8 (80%)

Q-3 Answer the questions below. **[10]**

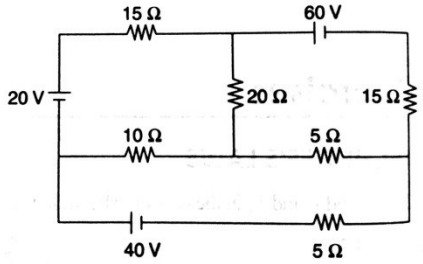
(a) Determine the current through the 5Ω resistor for the network using Nodal analysis. **[05]**



ANS: V1=13.41V, V2=7.06V, V3=-8.47V

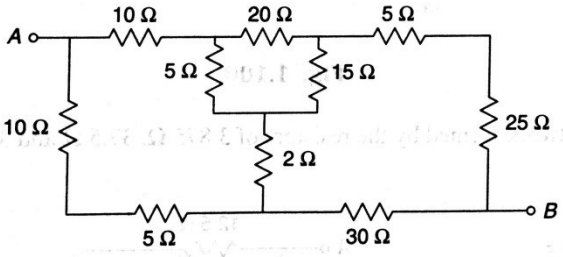
OR

(a) Find the current through the 20Ω resistor in the network shown in fig using Mesh Analysis. **[05]**

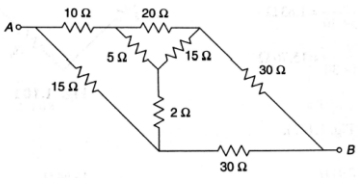


ANS: 1.46A

(b) Find the equivalent resistance between points A and B using Delta/Star transformation. **[05]**



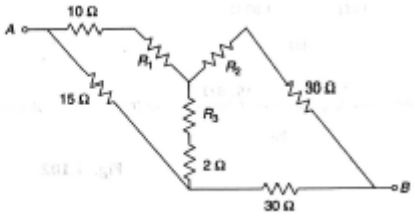
ANS:

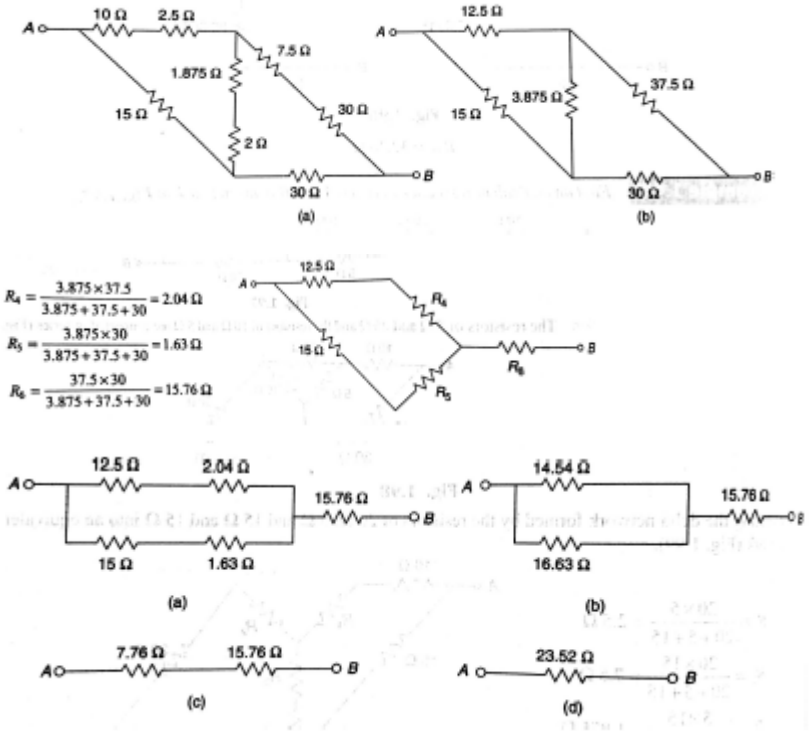


$$R_1 = \frac{20\times5}{20+5+15} = 2.5\,\Omega$$

$$R_2 = \frac{20\times15}{20+5+15} = 7.5\,\Omega$$

$$R_3 = \frac{5\times15}{20+5+15} = 1.875\,\Omega$$

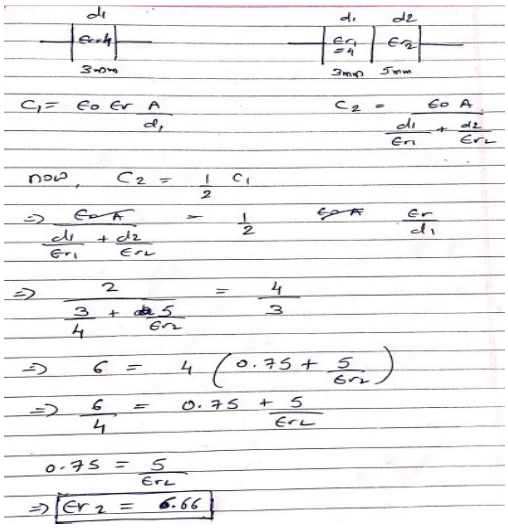




Q-4 Answer the following questions. **[10]**

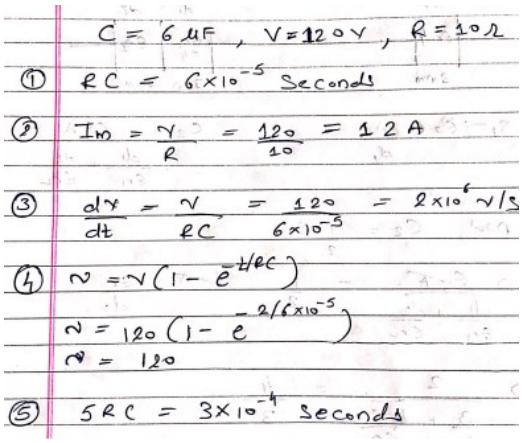
(a) A capacitance is composed of two plates separated by a sheet of insulating material 3 mm thick and $\varepsilon_r = 4$. The distance between the plates is increased to allow the insertion of a second sheet 5 mm thick and relative permittivity $\boldsymbol{\varepsilon_r}$. If the capacitance so formed is one-half of the original capacitance, find the value of $\boldsymbol{\varepsilon_r}$. **[05]**

ANS:



(b) A 6 μF capacitor is connected by closing the switch to a supply of 120 V through 10Ω resistance. Calculate (i) time constant (ii) initial charging current (iii) initial rate of rise of voltage across capacitor (iv) voltage across the capacitor 2 seconds after the switch has been closed (v) time taken for the capacitor to be fully charged. **[05]**

ANS:


C = 6 μF , V = 120 V , R = 10 Ω
① RC = 6×10⁻⁵ Seconds
② Im = V/R = 120/10 = 12 A
③ dv/dt = V/RC = 120/6×10⁻⁵ = 2×10⁶ V/s
④ v = V(1 − e^(−t/RC))
v = 120 (1 − e^(−2/6×10⁻⁵))
v = 120
⑤ 5RC = 3×10⁻⁴ seconds