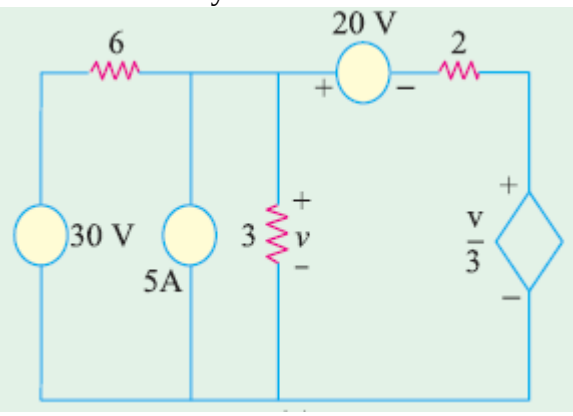
International Islamic University Chittagong
Department of Electrical and Electronic Engineering
Final Assignment, Autumn 2019
Course Code: **EEE 1101** Course Title: **Electrical Circuits I**
Full Marks: 40 Submission Time: Within 12 Hours from the scheduled starting time

[Answer all five questions given below. The figures in the right hand margin indicate full marks]

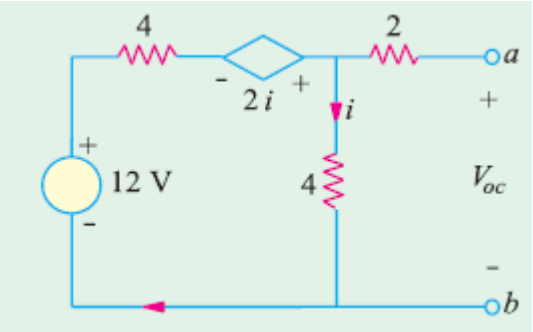
Set: EE

EE means last two digits of student ID are even
[Examples: ET193002, ET193220, ET193028 etc.]

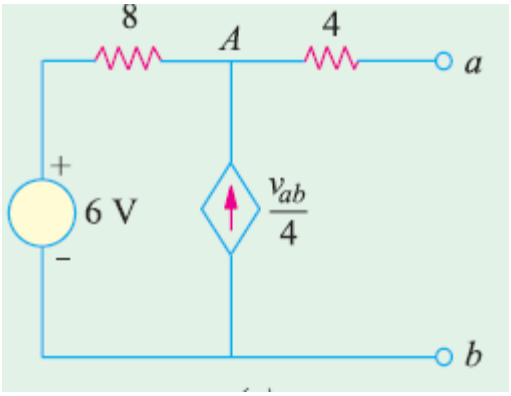
1 a) Use superposition theorem to find the voltage v in the following circuit. The upper end of the 30 V supply is positive and the direction of the current of 5 A current source is downward. Replace the 20 V source by a 10 V source. 4



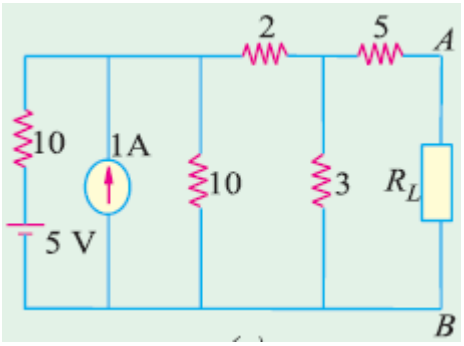
b) Find V_{th} and R_{th} for the circuit given below between the terminals a-b. Replace the 12 V source by a 20 V source. 4



2) a) Find the Norton equivalent circuit for the network between a-b. Replace the 6 V source by a 8 V source. 4

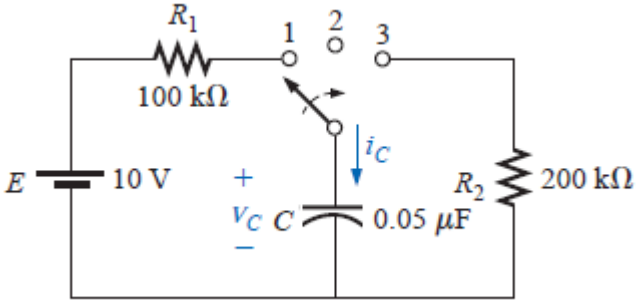


b) In the circuit shown below obtain the condition for maximum power transfer to the load R_L and determine the maximum power consumed by R_L. Replace the 1 A current source by a 2 A current source. 4



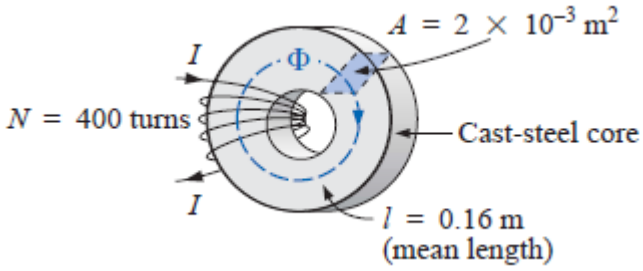
3) a) Three capacitors C_1, C_2 and C_3 are connected in parallel and the corresponding equivalent capacitance is C_P. Derive the equation for C_P. 4

b) For the R-C transient circuit given below replace the resistor R_2 by a 180 kΩ resistor. 4
(i) Find the mathematical expression for the transient behavior of the voltage across the capacitor of the circuit shown below if the switch is thrown into position 1 at t = 0 s.
(ii) Repeat part (i) for i_C.
(iii) Find the mathematical expression for the response of v_C and i_C if the switch is thrown into position 2 at t = 30 ms.
(iv) Find the mathematical expression for the voltage v_C and current i_C if the switch is thrown into position 3 at t = 48 ms.
(v) Plot the waveforms obtained in parts (i) through (iv) on the same time axis for the voltage v_C and current i_C using the defined polarity and current direction shown in the circuit.



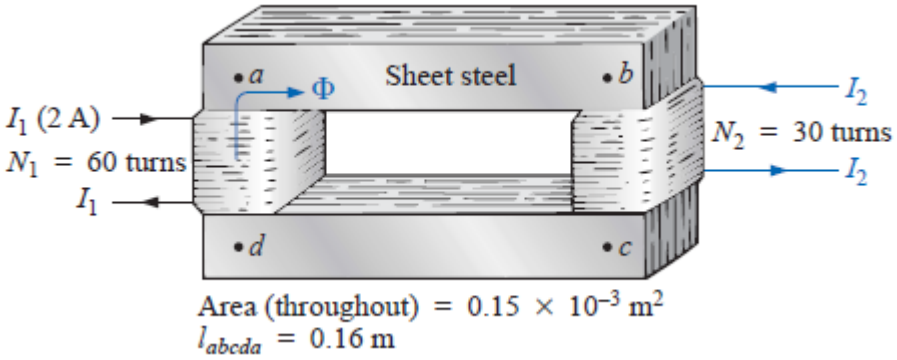
4) a) Classify materials with reference to relative magnetic permeability (μ_r). Derive the equation $B = \mu H$; Where the symbols have their usual meaning. 4

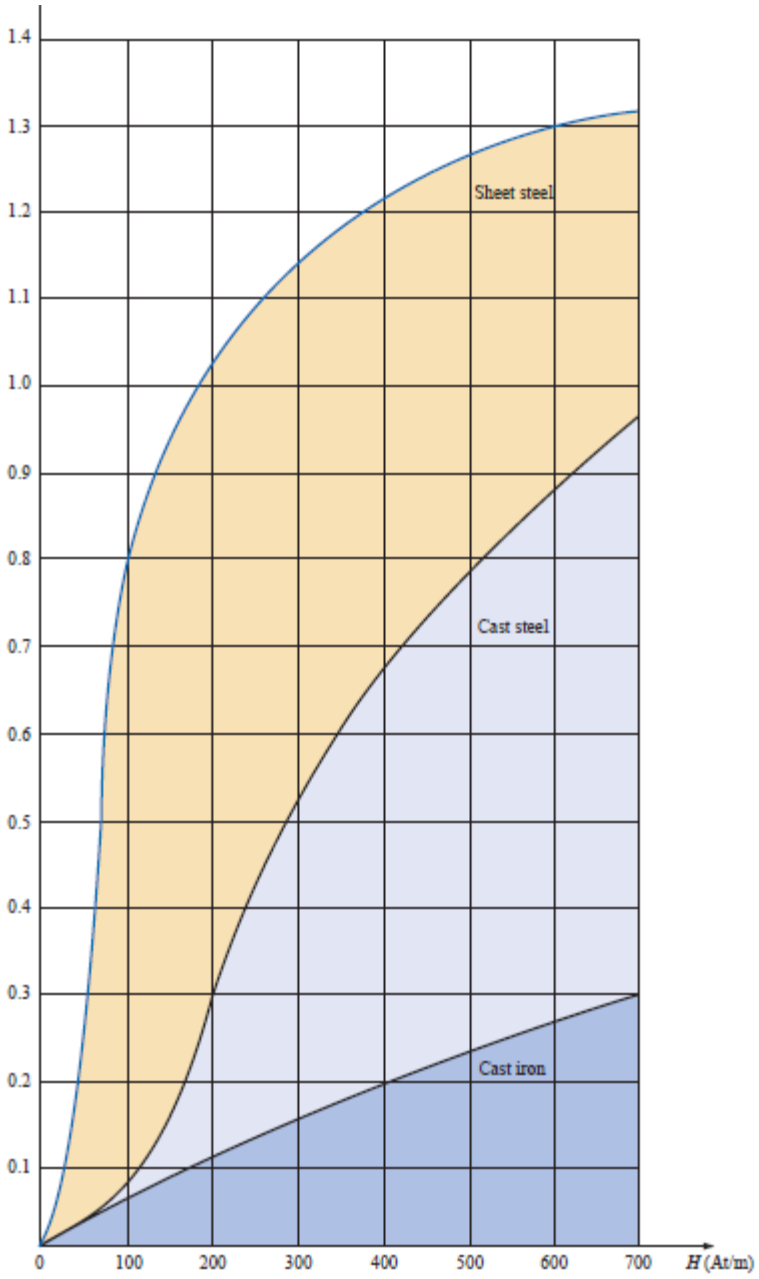
b) For the magnetic circuit given below replace the given mean length by l = 0.17 m. 4
(i) Describe hysteresis loop with diagram. (ii) Determine the current I required to establish a flux of $4x10^{-4}$ *Wb* in the series magnetic circuit given below. (iii) Determine μ and μ_r for the material under these conditions. Use the *B-H Plot* of Magnetic Materials attached with the question.



5) a) Analytically describe the benefit of using small air gap in a magnetic circuit. 4

b) Determine the secondary current I_2 for the transformer given below if the resultant clockwise flux in the core is $1.5X10^{-5}$ Wb. Replace N_2 by 35 turns. 4





B-H Plot of Magnetic Materials