



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2015/2016**

**COURSE NAME** : ELECTRICAL TECHNOLOGY  
**COURSE CODE** : BEE 10403  
**PROGRAMME** : BACHELOR OF ELECTRONIC  
ENGINEERING WITH HONOURS  
**EXAMINATION DATE** : DECEMBER 2015 / JANUARY 2016  
**DURATION** : 3 HOURS  
**INSTRUCTION** : ANSWER **ALL** QUESTIONS

**THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES**

- Q1** For a  $\Delta$ - $\Delta$  balanced system with line to line voltage of  $V_{ab} = 173\text{V}$  and load of  $Z_{\Delta} = 30 + j10\Omega$ , if the source voltages are in positive sequence. Investigate
- (a) The phase and line currents. (15 marks)
  - (b) Total average power, total reactive power and total complex power at the source. (10 marks)
- Q2** A closed magnetic circuit of cast steel contains a 7cm long path of cross-sectional area  $1.5\text{cm}^2$  and a 2cm long path of cross-sectional area  $0.5\text{cm}^2$ . A coil of 300 turns is wound around the 7cm length of the circuit and generated a current of 0.5A. The relative permeability of the cast steel is 850 H/m.
- (a) Calculate the reluctance in the 7cm cast steel. (8 marks)
  - (b) Determine the total reluctance in the closed magnetic circuit of cast steel. (9 marks)
  - (c) Investigate the flux density in the 7cm path. (8 marks)
- Q3** A 5kVA, 200V / 100V, 50Hz, single phase ideal two winding transformer is used to step up a voltage of 200V to 300V by connecting it as an auto transformer.
- (a) Show the connection diagram of the auto transformer that is used to step up a voltage of 200V to 300V with all important labels of  $V_L$ ,  $I_L$ ,  $V_{SE}$ ,  $V_C$ ,  $I_H$ , and  $V_H$ . (6 marks)
  - (b) Calculate the maximum kVA that can be handled by the autotransformer (without over loading any of the HV and LV coil). (10 marks)
  - (c) Investigate the kVA that is transferred magnetically and the kVA that is transferred by electrical conduction. (8 marks)

- Q4** (a) AC machines can be categorized as AC motors and AC generators. Describe
- (i) The differences between AC motor and AC generator. (2 marks)
  - (ii) Two (2) methods to increase the turning force (or torque) of a DC motor. (2 marks)
  - (iii) Two (2) disadvantages of a DC machine. (2 marks)
- (b) A 24V shunt DC motor in **Figure Q4(b)** has an armature resistance of  $0.5\Omega$  and a field resistance of  $100\Omega$ . At no load, the motor takes a line current of  $0.5A$  while running at 2500rpm. If the line current at full load is  $4A$ ,
- (i) Estimate the field current and the induced voltage with no load. (6 marks)
  - (ii) Estimate the full load speed and the speed regulation of the DC motor. (8 marks)
- (c) Explain briefly about
- (i) The working principle of synchronous motor. (3 marks)
  - (ii) The differences between synchronous machine and induction machine. (2 marks)

– END OF QUESTION –

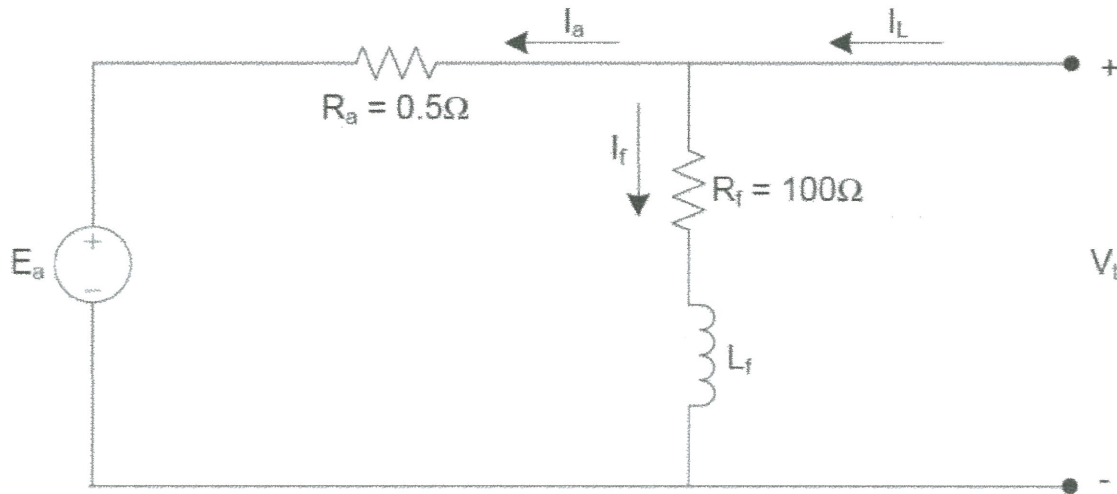
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**FIGURE Q4(b)**

**List of Formula and Constant**

1.  $\beta = \mu H$  (unit: Tesla, T)
2.  $mmf \text{ (or } F_m) = NI = H/l$  (unit: Ampere-turns, At)
3.  $S \text{ (or } R) = l/\mu A = mmf/\phi$  (unit: Ampere-turns/weber, At/Wb)
4.  $\phi_{max} = B_{max} a_{area}$  (unit: Weber, Wb)
5.  $E = 4.44 f N \phi_m$  (unit: Volt, V)
6.  $a = \frac{V_p}{V_e} = \frac{e_p}{e_s} = \frac{N_p}{N_s}$  (unit: -)

Permeability of vacuum  $\mu_o = 4\pi \times 10^{-7} \text{ Wb/At.m (or H/m)}$