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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : ELECTRIC POWER AND MACHINES
COURSE CODE : BNJ 20502
PROGRAMME : BNL
EXAMINATION DATE : JUNE/JULY 2016
DURATION : 2 HOURS
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS
ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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- Q1** (a) A 2.5kW electric motor is connected to a 230 V supply. Determine :
- (i) the current flowing in the motor (3 marks)
 - (ii) the resistance of the motor (3 marks)
- (b) (i) Determine the power dissipated by the element of an electric heater of resistance 20Ω when a current of 10 A flows through it. (3 marks)
- (ii) Referring to problem **Q1(b)(i)**, if the heater is ON for 10 hours determine the energy used and the cost if 1 unit of electricity costs RM1.50? (6 marks)
- (c) Analyse the waveforms in **Figure Q1(c)**. Hence determine the expression of signal 2. (6 marks)
- (d) Explain advantages of AC over DC in electrical power system. (4 marks)
- Q2** (a) Sketch the flow of main component/equipments required for domestic distribution system. Label clearly all parts. (4 marks)
- (b) A 300 kVA transformer is at full load with an overall power factor of 0.70 lagging and connected to a 11kV system.
- (i) Calculate active and reactive power of the system (5 marks)
 - (ii) Sketch the power triangle and label all related parameters (3 marks)
 - (iii) Calculate current drawn from the line (3 marks)
- (c) Determine the rating (in kilovars) of the capacitor required to improve the overall power factor to 0.90 lagging for the problem in **Q2(b)**. Compare with previous result and comment on the new current drawn from the line. (6 marks)
- (d) Explain the important of high power factor in electric power system. (4 marks)

- Q3** (a) State Faraday's Laws using diagram shown in **Figure Q3(a)**, . (4 marks)
- (b) Briefly explain :
- (i) electromagnetsim. (3 marks)
- (ii) electromagnetic induction (3 marks)
- (c) An ideal transformer, connected to a 240 V mains, supplies a 12 V, 150 W lamp. Calculate :
- (i) the transformer turns ratio (2 marks)
- (ii) secondary current (2 marks)
- (iii) the current taken from the supply (primary current) (3 marks)
- (d) A 200 kVA rated transformer has a full-load copper loss of 1.5 kW and an iron loss of 1 kW. Analyse the information and hence calculate the transformer efficiency at full load and 0.85 power factor. (8 marks)
- Q4** (a) **Figure Q4(b)** shows construction of DC motor. Discuss the following components :
- (i) stator
- (ii) rotor (armature) (8 marks)
- (b) The counter-emf of a motor is always slightly less than the applied armature voltage. Explain. (4 marks)
- (c) Referring to **Figure Q4(c)**, a shunt DC motor rating at 1500 r/min is fed by a 200V source. The line current is 25A and the shunt-field resistance is 100Ω . If the armature resistance is 0.1Ω , analyse the equivalent circuit and calculate the following:
- (i) the current in the armature (4 marks)
- (ii) the counter-emf (4 marks)
- (iii) the mechanical power developed by the motor (5 marks)

- Q5** (a) The power supplied to a three-phase induction motor is 32 kW and the stator losses are 1200 W. If the slip is 5%, determine :
- (i) the rotor copper loss (5 marks)
 - (ii) the total mechanical power developed by the rotor (4 marks)
 - (iii) the output power of the motor if friction and windage losses are 750 W (4 marks)
 - (iv) the efficiency of the motor, neglecting rotor iron loss (4 marks)
- (b) Explain about *slip* of an induction motor. (4 marks)
- (c) Name the principal components of an induction motor. (4 marks)

— END OF QUESTION —

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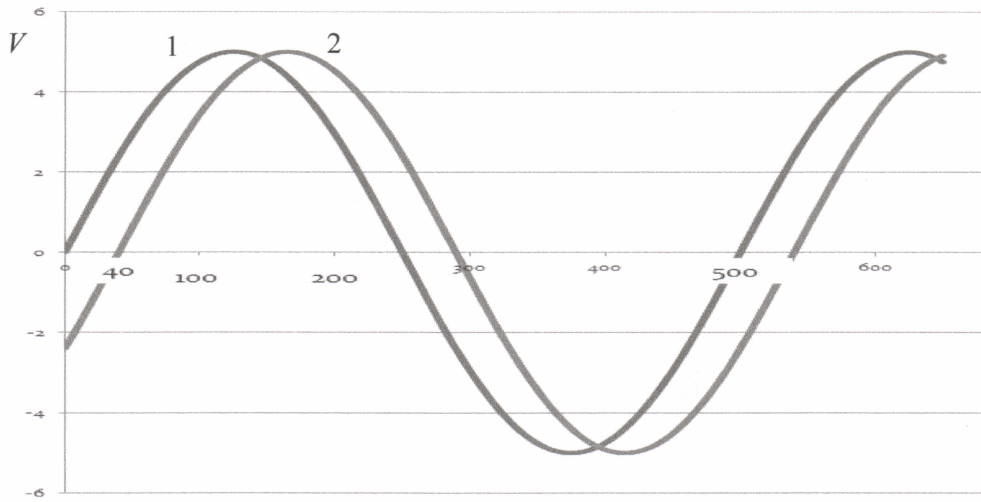


Figure Q1(c)

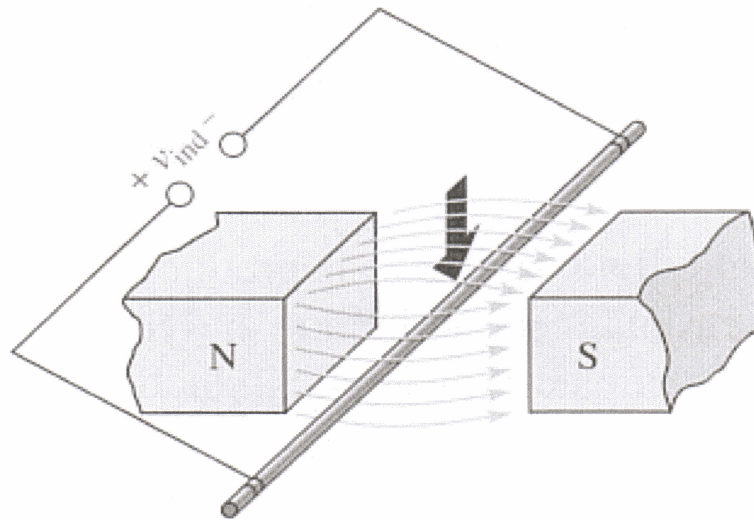


Figure Q3(a)

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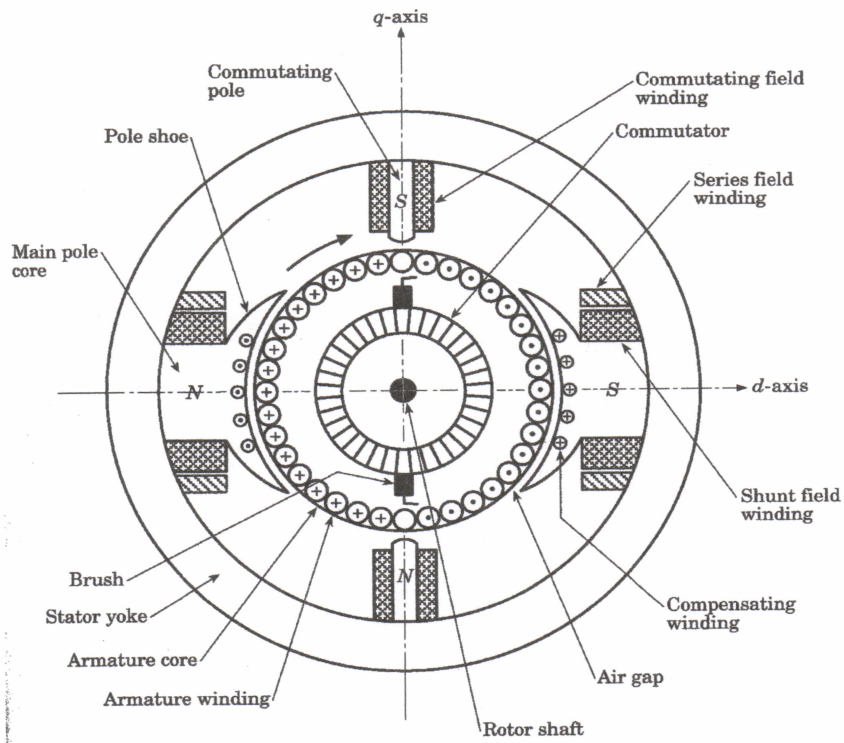


Figure Q4(b)

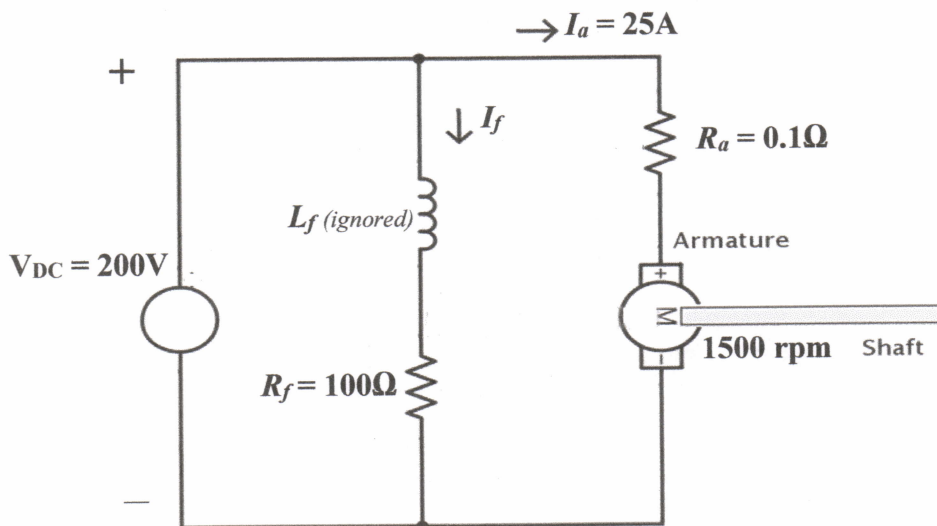


Figure Q4(c)

Note : Ignore the inductance L_f