



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

COURSE NAME : ELECTRICAL POWER AND MACHINES
COURSE CODE : BNJ 20502
PROGRAMME CODE : BNM/ BNL/ BNG
EXAMINATION DATE : JUNE/ JULY 2018
DURATION : 2 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1**
- (a) Calculate the resistance between points A and B (R_{AB}) for the resistor network shown in **Figure Q1(a)**.
(4 marks)
 - (b) Three identical capacitors are connected in delta to a 415 V, 50 Hz, 3-phase supply. If the line current is 15 A, determine the capacitance of each of the capacitors.
(6 marks)
 - (c) Based on electrical power system, illustrate complete diagram of typical voltage level in a power system from power generator until end user (domestic customer).
(10 marks)
- Q2**
- (a) Based on **Figure Q2(a)**, determine the apparent power of this load.
(2 marks)
 - (b) Determine the power factor of the load.
(2 marks)
 - (c) Determine the reactive power of the load.
(2 marks)
 - (d) A capacitor of 80 microFarads is used to improve the power factor. Determine the new reactive power.
(8 marks)
 - (e) Determine the new power factor.
(4 marks)
 - (f) List **TWO (2)** advantages of power factor correction.
(2 marks)
- Q3**
- (a) State Faraday's Law.
(2 marks)
 - (b) A ferromagnetic core is shown in **Figure Q3(b)**. The depth of the core (into the page) is 5 cm, and the other dimensions are as shown in **Figure Q3(b)**. There are 500 turns coil wrapped around the left side of the core. Assume that the relative permeability of the core is 1000.
 - (i) Determine the value of current that will produce a flux of 0.003 Wb.
(10 marks)
 - (ii) Determine the flux density at the right side of the core.
(2 marks)

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(iii) Demonstrate the flow of the magnetic flux induced in the ferromagnetic core in a magnetic circuit analogy.

(2 marks)

(c) A step-down transformer is rated at 75 kVA, 7200 V/240 V. Calculate the rated current on each side of the transformer. Determine the exciting current if it is 1.7 % of the rated current.

(4 marks)

Q4 (a) Differentiate any **THREE (3)** types of DC motors by sketching their equivalent circuit diagrams.

(6 marks)

(b) A series DC motor has an armature resistance of 0.6Ω and field winding resistance of 1.5Ω . In driving a certain load at 1200 rpm, the current drawn by the motor is 20 A from a voltage source of 220 V. The rotational loss is 150 W. Calculate:

(i) the back-emf,

(2 marks)

(ii) the mechanical power developed by the motor, and

(2 marks)

(iii) the efficiency of the motor.

(6 marks)

(c) Discuss the significance of back-emf produced in a motor.

(4 marks)

Q5 (a) Name the main components of an induction motor.

(2 marks)

(b) Explain the operating principles of an induction motor based on the diagram in **Figure Q5(b)**.

(4 marks)

(c) A 208V, 10 HP, four-pole, 60 Hz induction motor has a full-load slip of 5%. Calculate:

(i) the synchronous speed of the motor,

(2 marks)

(ii) the rotor speed at the rated load, and

(2 marks)

(iii) the rotor frequency of the motor.

(2 marks)

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- (d) An induction motor rotates at 1120 rpm has a power flow as shown in **Figure Q5(d)**. The vertical arrow indicates the losses at several stages in the motor. Given the slip is 5 %.
- (i) Analyze the diagram, hence, determine the efficiency of the motor. (4 marks)
- (ii) Calculate the torque at the given speed. (4 marks)

-END OF QUESTIONS -

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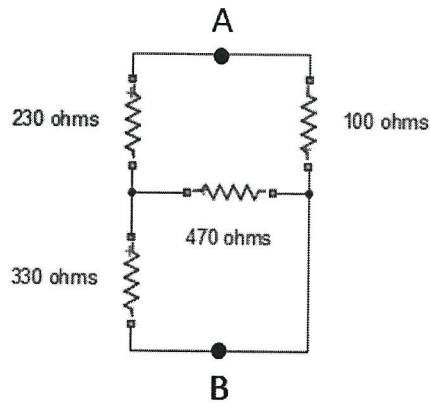
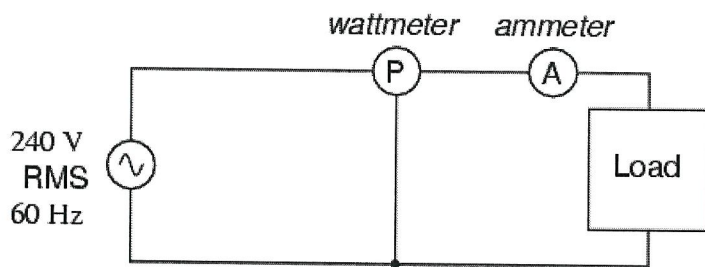


Figure Q1(a)



Wattmeter reading = 1.5 kW
Ammeter reading = 9.615 A RMS

Figure Q2(a)

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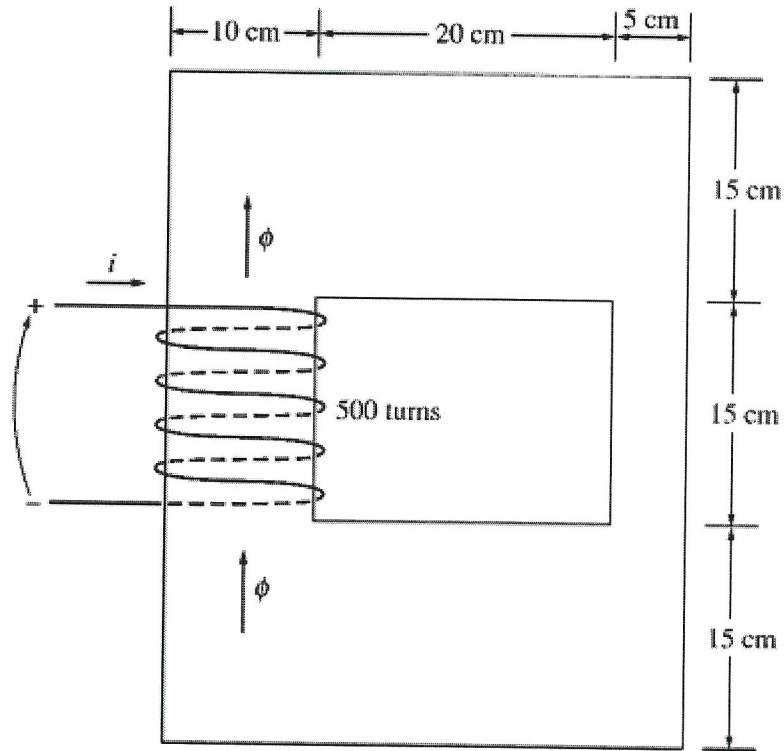


Figure Q3(b)

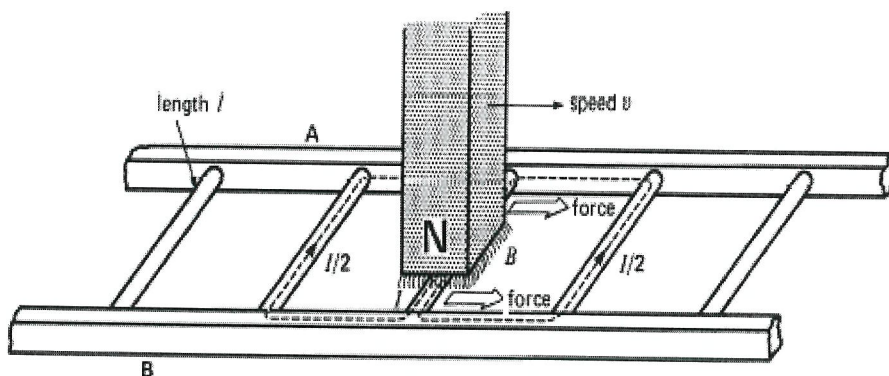


Figure Q5(b)

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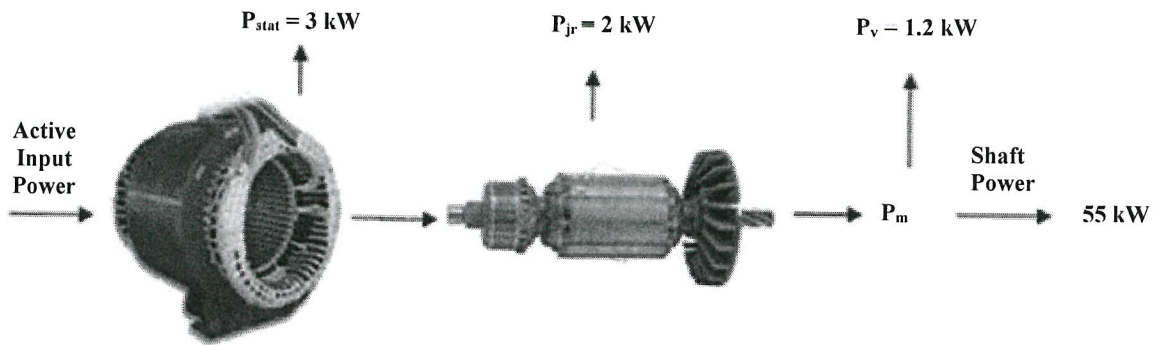


Figure Q5(d)

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