Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	ELECTRIC MACHINES AND DRIVES
COURSE CODE	:	BNR 31403
PROGRAMME	:	BND
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) Explain Faraday's laws of magnetism using appropriate diagram.

(4 marks)

(b) Referring to **Figure Q1(b)** :

i) Name the transformer type

(2 marks)

ii) Discuss its operation

(4 marks)

iii) List **THREE(3)** advantages of the transformer

(3 marks)

(c) A single-phase transformer has a voltage ratio of 6:1 and the H.V. winding is supplied at 540 V. The secondary winding provides a full load current of 30 A at a power factor of 0.8 lagging. Analyse the circuit and find :

i) the rating of the transformer,

(4 marks)

ii) the power supplied to the load,

(4 marks)

iii) the primary current

(4 marks)

Hint : ignore all losses

Q2 (a) Discuss the significant of back emf in electric DC motor.

(5 marks)

(b) **Figure Q2(b)** shows the torque-speed-current characteristic of a series DC motor.

(i) Sketch the schematic diagram of a series DC motor.

(3 marks)

(ii) Discuss this motor under load condition.

(4 marks)

(c) Referring to **Figure Q2(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 to determine 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)

Q3 (a) Explain about *slip* of an induction motor.

(4 marks)

(b) Sketch the active power flow diagram of 3-phase induction motor and label necessarily the important power losses at all stages.

(6 marks)

(c) 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

(3 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)

Q4 (a) Discuss the reason why most motors use motor starter when starting.

(3marks)

(b) Speed of DC motor is governed from the equation

$$n = \frac{60V_{DC}}{Z\emptyset}$$

Explain the two most common methods to control speed of DC motors.

(4 marks)

(c) Sketch the schematic diagram of basic speed control DC motor drives with appropriate labelling.

(6 marks)

(d) An industrial drive has to develop the torque-speed characteristic given in **Figure Q4(d)**. A DC shunt motor is used, powered by two converters back-to-back. The converters function alternately. Analyse and determine the state of each converter over the 26-seconds operating period and indicate the polarity at the terminals of the DC machine. Clockwise rotation gives positive speed and torque.

(12 marks)

Q5 (a) State ***FOUR* (4)** reasons why ac motors are now can do outstanding job similar to DC motors

(6 marks)

(b) Referring to **Figure Q5(b)** why is the region indicated on a torque-speed curve of an induction motor showing a slip variation between 0-10 % and is depicted as a stable region?

(5 marks)

(c) Sketch the schematic diagram of AC electronic drives using pulse-width modulation (PWM) system with appropriate labelling.

(6 marks)

(d) Analyse the AC variable speed drive systems as shown in **Figure Q5(d)** and compare the differences between the two.

(8 marks)

- END OF QUESTION –

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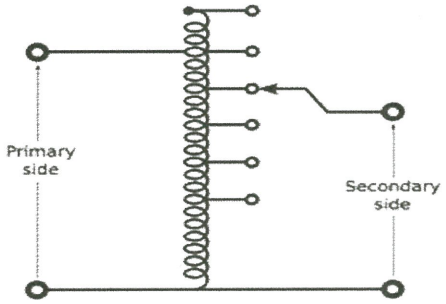


Figure Q1(b)

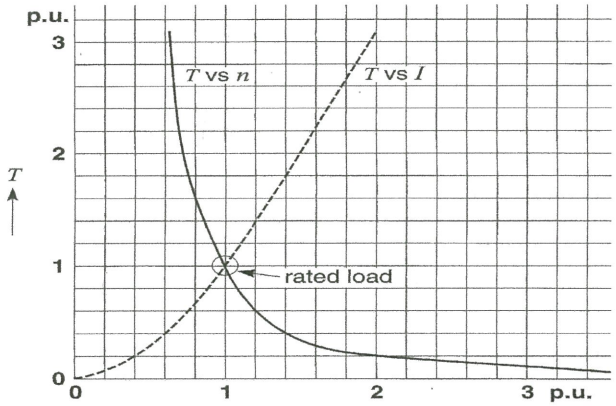
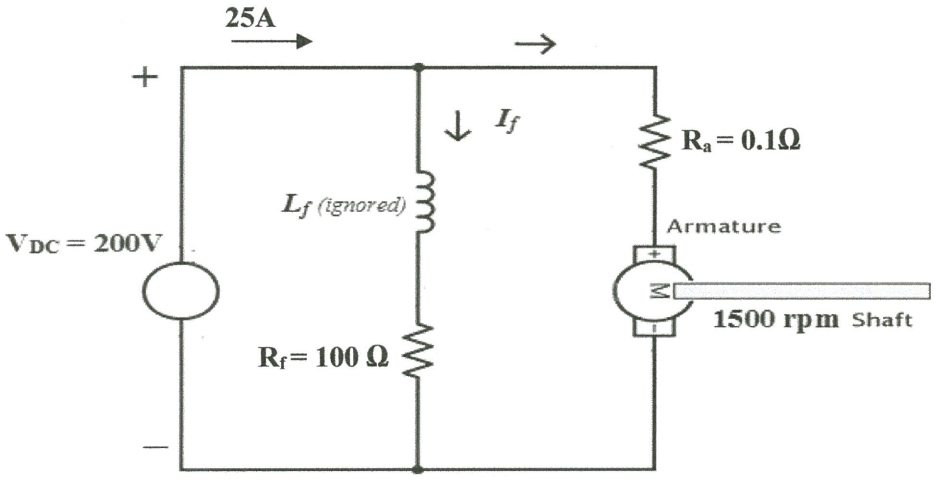


Figure Q2(b)



Note : *Ignore the inductance* L_f

Figure Q2(c)

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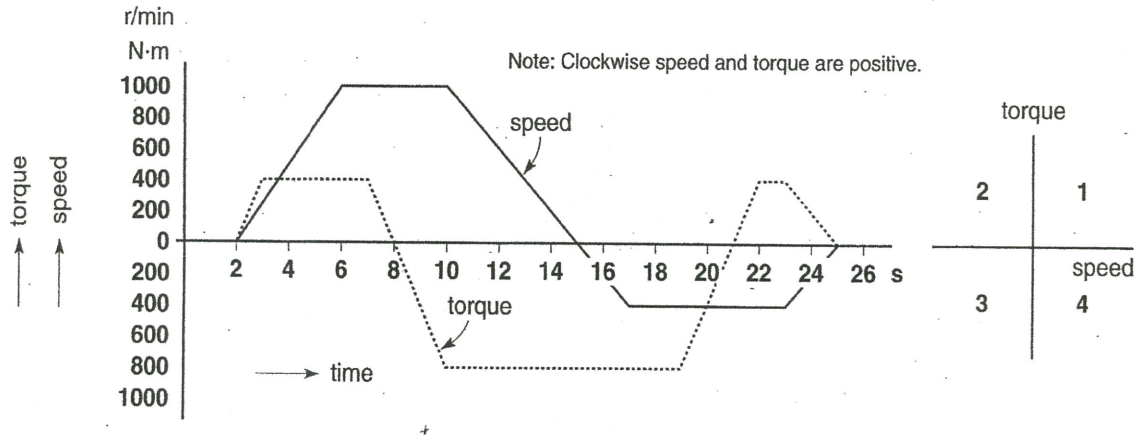

Figure Q4(d)

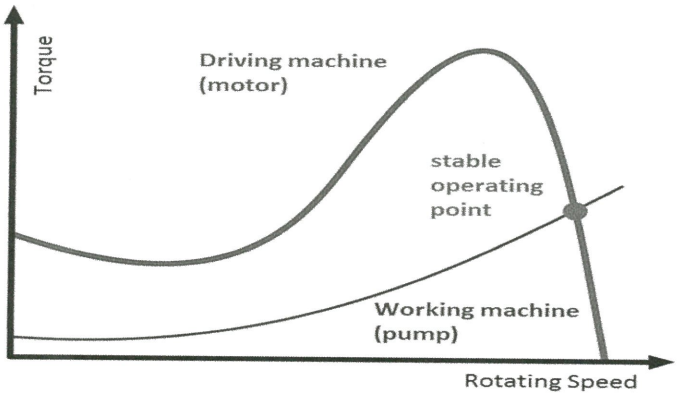

Figure Q5(b)

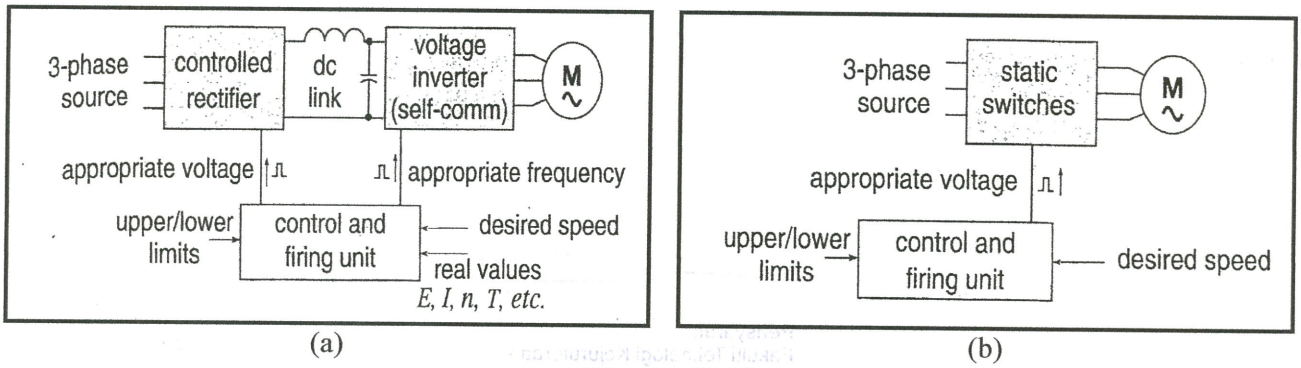

Figure Q5(d)