



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

Complete, fold and seal
(see note 2 below)

SURNAME:

BUNYAN

FORENAME(S):

JAMES

ALEXANDER

1	Student Number	1708795
2	Title of Examination Paper	Electrical Machines M6X00373
3	Module Code	M6X00373
4	Date and Time of Examination	17/5/19 15.00
5	Examination Venue	SA1 Room 310
6	Seat Number	G064
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	10 10
2	6 6
3	9 9
4	2 2
6	5 5
7	3 3
Total	35 35

(Gweler yr ochr arall am y fersiwn Cymraeg)

70%

70% / 1.1.



1. Cast-Iron.

$$\Phi = 560 \mu \text{wb}$$

$$N = 1200$$

$$L_1 = 650 \text{ mm}$$

$$L_a = 90 \text{ mm}$$

$$\text{CSA} = 40 \times 100$$

$$\frac{\Phi}{\text{CSA}} = \frac{(560 \times 10^{-6})}{(40 \times 10^{-3}) \times (100 \times 10^{-3})}$$

$$B = 0.14 \text{ T}$$

$$B \cdot H \text{ curve} = 325 \text{ A/Tm}$$

$$= 325 \times (650 \times 10^{-3})$$

$$= 211.25 \text{ A-T}$$

$$= \frac{0.14}{(4\pi \times 10^{-7})}$$

$$= 111408.4602$$

$$= 111408.4602 \times (90 \times 10^{-3})$$

$$= 10026.761 \text{ A-T}$$

$$I = \frac{10026.761 + 211.25}{1200}$$

$$= 8.53 \text{ A}$$

10

10

2.
a)

$$\begin{aligned}
 N &= 1600 \\
 w &= 150 \text{ mm} \\
 d &= 250 \text{ mm} \\
 B &= 0.75 \text{ T} \\
 \text{RPM} &= 3000
 \end{aligned}$$

$$\text{emf} = N B A \omega \sin(\omega t)$$

$$\begin{aligned}
 A &= (150 \times 10^{-3}) \times (250 \times 10^{-3}) \\
 &= 0.0375
 \end{aligned}$$

$$\omega = 2\pi f$$

$$f = \frac{3000}{60} = 50 \text{ Hz}$$

$$\begin{aligned}
 \text{emf} &= 1600 \times 0.75 \times 0.0375 \times (2\pi \times 50) \\
 &= 14137.17 \text{ V}
 \end{aligned}$$

$$b) \Phi = BA$$

$$= 0.75 \times 0.0375$$

$$= 0.028125 \text{ wb}$$

precis. on?

3. Induction motors and Synchronous motors both have a stator and a rotor.

- In an induction motor the AC supply is on to the stator, the windings in the stator then generate a magnetic field (RMF) that induces in the squirrel cage of the rotor and begins to turn the motor.

An induction motor is self starting.

- But in a synchronous motor there are two supply's, a AC supply on to the stator and a DC supply on to the rotor. A synchronous motor is not self starting, but can be made into a self starting motor by adding a squirrel cage on to the rotor.

This will then begin to turn the motor with the same principle as an induction motor, but once it gets up to speed the windings in the rotor takes over.

- The synchronous motor runs at a constant speed regardless of load, but an induction motor is affected by the load.

A synchronous motor stays at a constant speed because the magnetic fields in the stator and rotor become opposite, which means they lock on to each other and turn at the same time.

- An induction motor can never spin at synchronous speed because the rotor can never turn as quick as the magnetic field, the magnetic field is essentially pulling the rotor behind it.

4. $B = 0.45 \text{ T}$
 $l = 150 \text{ mm}$
 $R = 0.5 \Omega$
 $V = 24 \text{ V}$

$$F = N B I l \sin \theta$$

$$I = \frac{V}{R} = \frac{24}{0.5}$$

$$= 48 \text{ A}$$

$$F = 1 \times 0.45 \times 48 \times (150 \times 10^{-3}) \times \sin \theta$$

$$= 3.24 \text{ N}$$

3* Cont. A Synchronous motor is used on more specialised equipment as the speed can be controlled by changing the frequency of the motor. ✓
 An induction motor ~~can't~~ can be controlled as well as a Synchronous motor. ✓

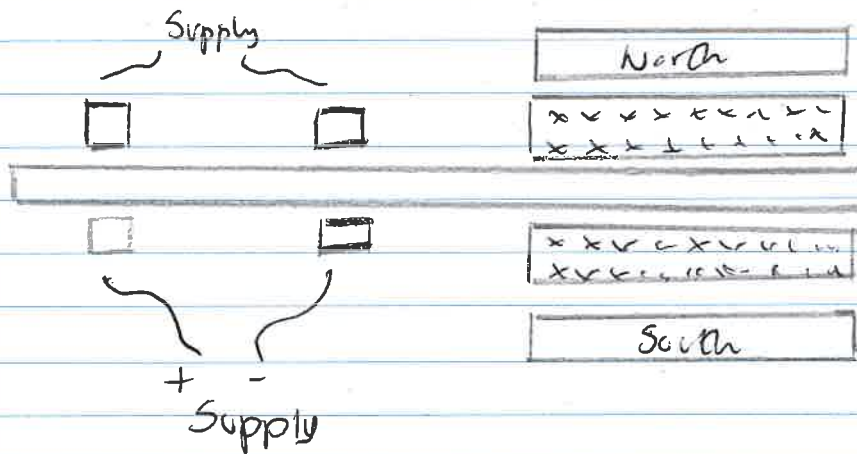
- A Synchronous motor can be used to increase the power factor of the system, but an induction motor can not do this. ✓
- An induction motor has slip, which is the difference between the rotating magnetic field and the speed of the motor. Synchronous motors do not have this problem. ✓
- A Synchronous motor is more efficient than an induction motor. The efficiency is between 90-92%. ✓

5.



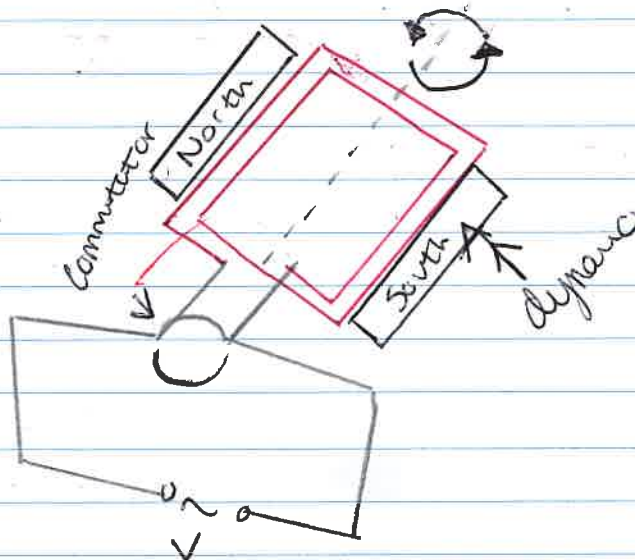
6. A dynamo is used for generating DC voltage. An alternator generates AC voltage that needs to be converted into DC, by either using a rectifier or a commutator. ?

A ~~across~~ dynamo supply's the brushes on the alternator with an AC supply, this is then converted into DC.



As we can see above there is a supply on to the brushes, a magnetic field is created in the windings that will turn the alternator.

A commutator can also be used, which involves changing from two slip rings to one.



With the single slip ring the polarity is reversed on the connections.

Because of the single commutator only one polarity will be given as an output.

The more coils that are added the more constant the output.

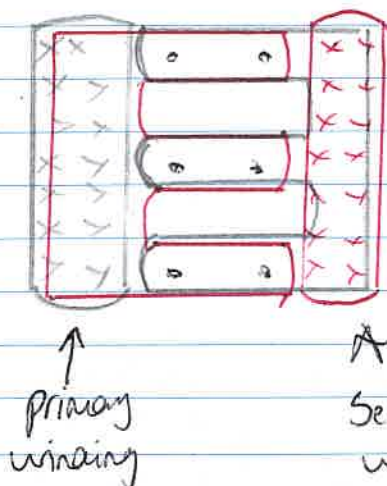
05

5

7. A shell type transformer are called E+I types.

The windings sit on top of each other and induce the voltage directly from the primary to the secondary winding.

This means that the E+I type has less flux leakage, as it does not have to be transferred through the transformer core.



This image shows the primary and secondary windings both sitting on top of each other.

? indeed!

3

3