Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes

Q1.

(a) the core focuses / directs the magnetic field round to the secondary ✔

Ensures more of the flux from the primary coil links with the secondary coil

1

(b) made from soft iron to allow easy magnetization and demagnetization / reduce hysteresis loss ✔

laminated (structure) to reduce eddy currents ✔

made from high resistivity metal to reduce eddy currents ✔

Do not allow "reduce energy loss" as this is implicit in question.

MAX 2

(c) To produce a continually changing (magnetic) flux in the core✔

1

(d) $N_P = N_S V_P / V_S = 300 \times 230 / 20 = 3500$ (3450) turns ✔

1

(e) efficiency = power out / power in = 65 / (230 × 0.30) ✔

= 0.94 ✔ or 94%

2

[7]

Q2.

(a) Induced current such as to opposes the change producing it✓

Switch on current increases the flux through Y✓

Current opposite direction / anticlockwise to create opposing flux✓

Switch off flux thorough Y due to X decreases so current travels clockwise to create flux to oppose the decrease✓

one marks for Lenz's law statement
*two for explaining what happens at switch on **OR** switch off adequately*
one for completing the argument for switch on and off adequately

4

(b) Determines correctly in the calculation two of V_{pk}(5.6±1 μV) , A (0.096 m^2) and ω(9.4 rad

s^{-1})β✓

Substitutes all three in $v = BAn\omega$ ignoring powers of 10 and calculation errors for A and / or ω provided they have been attempted with working shown✓

B_H = 12.4 nT✓

Allow 2 or 3 sf

3

[7]

Q3.

(a) *(Faraday's law)*
(induced) emf ∝ rate of change of flux (linkage) ✔
(Lenz's law)
direction of induced emf (or current) ✔
is such as to oppose the change (in flux) producing it ✔

In either order.

Allow "(induced) emf = rate of change of flux linkage".

Ignore incorrect reference to names of laws.

3

(b) (i) current in coil produces magnetic field or flux
(that passes through disc) ✔
rotating disc cuts flux inducing / producing emf **or** current (in disc) ✔
induced (eddy) currents (in disc) interact with magnetic field ✔
force on (eddy) currents slows (or opposes) rotation (of disc) ✔

***Alternative** for last two points:*

(eddy) currents in disc cause heating of disc ✔

energy for heating comes from ke of disc or vehicle (which is slowed) ✔

max 3

(ii) *Advantage*: any one ✔
- no material (eg pads or discs or drums) to wear out
- no pads needing replacement
- no additional (or fewer) moving parts

Disadvantage: any one ✔
- ineffective at low speed **or** when stationary
- dependent on vehicle's electrical system remaining in working order
- requires an electrical circuit (or source of electrical energy) to operate whereas pads do not

Answers must refer to advantages and disadvantages of the <u>electromagnetic</u> brake.

Only accept points from these lists.

2

[8]