M1.C

[1]

M2.(a) (i) 128 V ✓

1

(ii) 64 V

CE from (i)

1

(iii) V_{rms} = 64 / √2 ✓=45.3 V ✓

CE from (ii)

2

(iv) frequency = 1 / 0.01 ✓= 100 ✓ Hz ✓

do not accept kHz for unit mark unless correct for candidate value

if use 10 s instead of 10 ms then can score second two marks

3

(b) horizontal line ✓

through y = 45 (44 − 48) x =0 ✓

CE from (a)(iii)+ / - half square

straight line must extend to at least to 6.0 ms

2

(c) connect to *y-input* ✓

adjust / change time base ✓

so that each division is 2.0 ms OR 20 ms across screen ✓

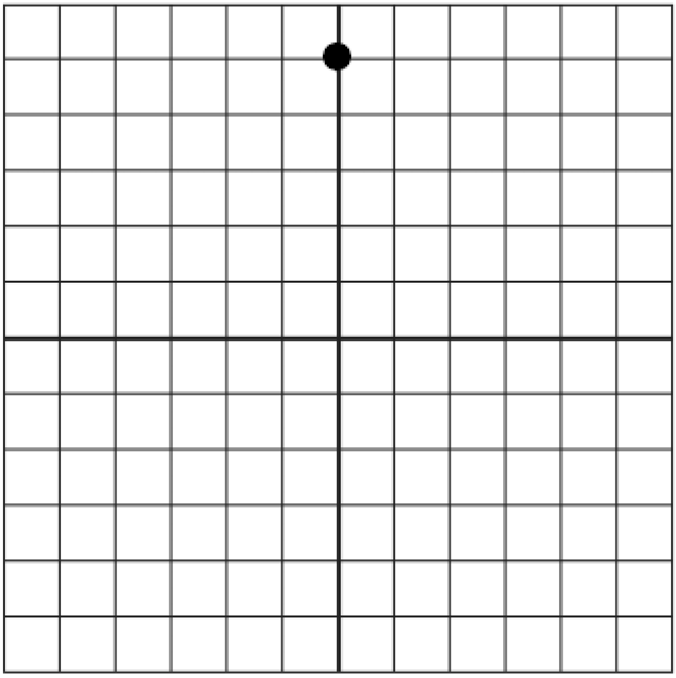
reference to y-gain / sensitivity ✓

if inappropriate numbers quoted for y gain then lose last mark

3max

[12]

M3. (a)



1

(b) (i) the **voltage reverse**/**changes** direction/sign ✓

this makes **the spot** move up and down **or** correct explanation of lack of horizontal movement ✓

2

(ii) length of line = 8 divisions

peak to peak = 8 × 0.5 = 4.0 V ✓✓

2

(iii) (peak = 2.0 V)

rms = $2.0/\sqrt{2}$ = 1.4 V ✓

2

[7]

M4. B

[1]

M5. (a) the square root of the mean of the squares of all the values of the voltage in one cycle **(1)**

or the equivalent dc/steady/constant voltage that produces the same **heating effect**/**power (1)**

1

(b) (i) peak voltage = 230 × √2 **(1)**

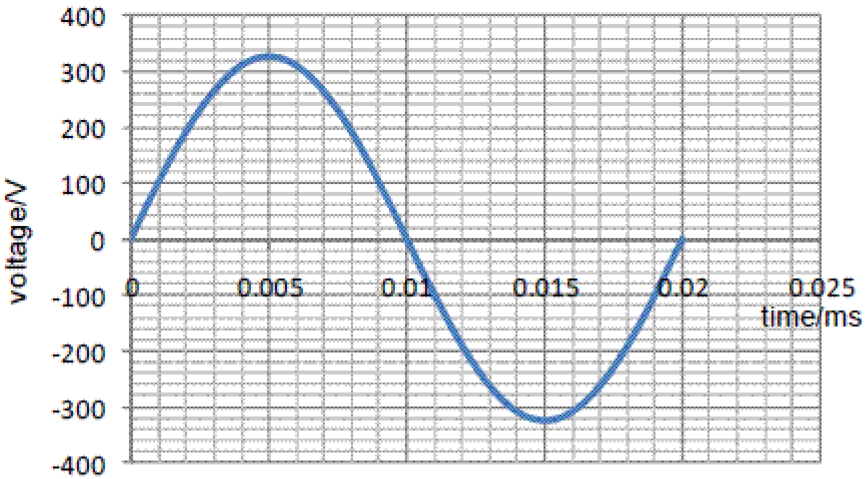
peak voltage = 325 V (or 324 V) **(1)**

2

(ii) average power = 230 × 0.26 = 60 W **(1)**

1

(c)



shape and symmetrical with consistent values of x at y = 0 and consistent y_{max} (must be at least one cycle) **(1)**

appropriate scale y-axis **(1)**

correct peak values (to within one 2 mm square) **(1)**

correct period (accept 0.02 **or** 20) **(1)**

4

[8]

M6. (a) (i) (vertically) downwards **(1)**

1

(ii) force F is perpendicular to both B and I [**or** equivalent correct explanation using Fleming LHR] **(1)**

magnitude of F changes as size of current changes **(1)**

force acts in opposite direction when current reverses [**or** ac gives alternating force] **(1)**

continual reversal of ac means process is repeated **(1)**

max 3

(b) appreciation that maximum force corresponds to peak current **(1)**

peak current = 2.4 × $\sqrt{2}$ = 3.39 (A) **(1)**

F_{max} (= $B\,I_{pk}\,L$) = 0.22 × 3.39 × 55 × 10^{-3} **(1)** (= 4.10 × 10^{-2} N)

3

(c) wavelength (λ) of waves = $\left(=\frac{c}{f}\right)=\frac{64}{80}$ = 0.80 (m) **(1)**

length of wire is λ/2 causing fundamental vibration **(1)**

[**or** λ of waves required for fundamental (= 2 × 0.40) = 0.80 m **(1)**

natural frequency of wire $\left(=\frac{c}{\lambda}\right)=\frac{64}{0.80}$ = 80 (Hz) **(1)**]

wire resonates (at frequency of ac supply) [**or** a statement that fundamental frequency (or a natural frequency) of the wire is the same as applied frequency] **(1)**

3

[10]

M7. C

[1]

M8. (i) 10.0 (V) **(1)** 1

(ii) $V_{rms} = 10.0/\sqrt{2} = 7.1$ (V) **(1)** 1

(iii) time period = 3 × 2 = 6 (ms) **(1)** 1

(iv) frequency = 1/0.006 or 1/6 **(1)**

frequency = 167 **(1)** (Hz) 2

[5]

M9. (a) (i) use of 1.5 cycles **(1)**

conversion to time eg time for 1.5 cycles = 10 × 1.5 = 15ms **(1)**

calculation of frequency eg frequency = 1 / 0.010 = 100 ± 3Hz **(1)**

(ii) peak voltage = 1.5 × 2 **(1)** = 3.0V **(1)**

(iii) rms voltage = $3.0/\sqrt{2}$ **(1)** (ce from (a) (i)) rms voltage = 2.12V **(1)**

7

(b) vertical line is formed **(1)**

of length equal to twice the peak voltage **(1)**

because trace no longer moves horizontally
or spot moves **just** up and down **(1)**

max 2

[9]