Electromagnetic Theory: PHAS3201, Term 1: 2015
Numerical Answers to Past Exams

1 2010/11

None.

2 2011/12

3. $\mu_1 = 1.9$ $H_1 = 3.1 \times 10^5$ T

4. a) $v = 1.0 \times 10^8$ m/s
   b) $n = 3.0$
   c) $k = 1.3 \times 10^3$ m^{-1}

7. b ii) $\theta_{\mathrm{B}} = 52.4^\circ$

9. c ii) $\theta = 90^\circ$
   c iii) $\langle N \rangle_{\max} = 7.5 \times 10^{-4}$ W m^{-2}

10. f i) $N_e = 6.99 \times 10^{27}$ m^{-3}
    f ii) $l = 489$ nm

3 2012/13

1. b) $M_{\mathrm{S}} = 6.62 \times 10^{17}$ A m^{-1}

7. d ii) Overall: 9.6%

9. b iv) $g = 5.74 \times 10^5$ S $v_p = 1.32 \times 10^6$ m/s

4 2013/14

3. a) $k = \left[4.5 \times 10^6 + \mathrm{i}\left(6 \times 10^{-5}\right)\right]\ \mathrm{m}^{-1}$
   b) 0.94

6. c) $N_e = 1.00 \times 10^{12}\ \mathrm{m}^{-3}$

7. a i) $D_{\mathrm{slab}} = 1.1 \times 10^{-7}\ \mathrm{Cm}^{-2}$
   a ii) $E_{\mathrm{slab}} = 2.0 \times 10^{3}\ \mathrm{Vm}^{-1}$
   a iii) $P_{\mathrm{slab}} = 8.9 \times 10^{-8}\ \mathrm{Cm}^{-2}$
   b ii A) $\rho_{\mathrm{p}} = -a$
   b ii B) $\sigma_{\mathrm{p}} = aR\cos^2\theta$
   b ii C) $Q = 0$

8. a iv) $\theta = 14.6^\circ$
   b iv A) $\theta_{\mathrm{B}} = 56.3^\circ$

9. d ii) $\mathbf{E}_0 = 7.1 \times 10^{-7}\ \hat{\boldsymbol{\theta}}\ \mathrm{Vm}^{-1}$
   d iii) $\mathbf{B}_0 = 2.4 \times 10^{-15}\ \hat{\boldsymbol{\phi}}\ \mathrm{T}$

5 2014/15

3. a) $\frac{u_{\mathrm{elec}}}{u_{\mathrm{mag}}} = 4.4 \times 10^{-5}$

7. c i) $d = 1.44\ \mathrm{cm}$
   c ii) $d = 9.1 \times 10^{2}\ \mathrm{m}$

8. d ii) $\overline{\mathbf{N}} = 2.9 \times 10^{-15}\ \mathrm{Wm}^{-2}\ \hat{\mathbf{r}},$ with $\hat{\mathbf{r}} = \frac{1}{3}\left(2.0\hat{\mathbf{x}} - 2.0\hat{\mathbf{y}} + 1.0\hat{\mathbf{z}}\right)$

10. h) $\Delta t = 4.0\ \mathrm{s}$