1.(a) Electric field exists only for radius $a < r < b$.
Gauss's Law: $E \cdot 2\pi r D = Q/\epsilon_o \quad \Longrightarrow \quad E = Q/(2\pi\epsilon_o D r)$ in the radial direction.
Magnetic field exists inside the rotating shell, for $r < b$.
Ampere's law: $B \cdot D = \mu_o Q/(2\pi/\omega) \quad \Longrightarrow \quad B = \mu_o Q\omega/(2\pi D)$ in the $-z$-direction.
(b) Poynting vector $\vec{S} = \vec{E} \times \vec{B}/\mu_o$ exists only between the shells $a < r < b$.
$S = EB/\mu_o = Q^2\omega/(4\pi^2\epsilon_o D^2 r)$ in the ϕ direction.
(c) The angular momentum density $\vec{\ell} = \vec{r} \times \vec{\wp}$ also exists only between the shells $a < r < b$.
$\ell = r \cdot \mu_o\epsilon_o S = Q^2\mu_o\omega/(4\pi^2 D^2)$ in the z-direction. So that the total angular momentum would be $L = \ell\pi(b^2 - a^2)D = Q^2\mu_o\omega(b^2 - a^2)/(4\pi D)$ in the z-direction.

2.(a) Due to the symmetry of the problem, the direction of the E-field will be in the $-x$-direction on the $y - z$ plane.
(b) Gauss's law gives a field magnitude $E \cdot 2\pi r D = \lambda D/\epsilon_o \quad \Longrightarrow \quad E = \lambda/(2\pi\epsilon_o r)$ due to one of the line charges and with $r = \sqrt{a^2 + y^2}$. We need only the component of the field in the $-x$-direction. That will bring in a factor of a/r. So the field on the $y - z$ plane due to the two line charges will be $E = 2a\lambda/(2\pi\epsilon_o r^2) = a\lambda/[\pi\epsilon_o(a^2 + y^2)]$ in the $-x$ direction.
(c) From symmetry, we know that the force between the charges will be in the $\pm x$ direction. The surface element on the $y - z$ plane is also in the x-direction. So, we will need to calculate only the T_{xx} element: $T_{xx} = -\epsilon_o E_x^2/2 = a^2\lambda^2/[2\pi^2\epsilon_o(a^2 + y^2)^2]$
(d) If we now integrate over a strip of heigth D in the z-direction, and extending to $\pm\infty$ in the y-direction on the $y - z$ plane,
$F_x = \int_0^D dz \int_{-\infty}^{\infty} dy \, T_{xx} = Da^2\lambda^2/(2\pi^2\epsilon_o) \cdot \int_{-\infty}^{\infty} dy/(a^2 + y^2)^2$.
Using the transformation $y = a\tan\phi$ so that $(a^2 + y^2)^2 = a^4/\cos^4\phi$ and $dy = a \, d\phi/\cos^2\phi$ we get $\int_{-\infty}^{\infty} dy/(a^2 + y^2)^2 = (1/a^3)\int_{-\pi/2}^{\pi/2} \cos^2\phi \, d\phi = \pi/(2a^3)$.
This then gives $F_x/D = \lambda^2/[2\pi\epsilon_o(2a)]$ as expected.

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3. (a) $\vec{E} = E_o\hat{y}[\exp(ik(\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t) - \exp(ik(-\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t)]$

$$\begin{aligned}\vec{B} = (E_o/c)[&((\hat{z}\cos\theta + \hat{x}\sin\theta) \times \hat{y}) \exp(ik(\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t) \\ &-((-\hat{z}\cos\theta + \hat{x}\sin\theta) \times \hat{y}) \exp(ik(-\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t)] \\ = (E_o/c)[&(-\hat{x}\cos\theta + \hat{z}\sin\theta) \exp(ik(\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t) \\ &-(\hat{x}\cos\theta + \hat{z}\sin\theta) \exp(ik(-\hat{z}\cos\theta + \hat{x}\sin\theta) \cdot \vec{r} - i\omega t)]\end{aligned}$$

(b)
$$\begin{aligned}\overline{\vec{S}} &= \text{Re } \vec{E}^* \times \vec{B}/(2\mu_o) \\ &= E_o^2/(2\mu_o c)\text{Re}\{(\hat{z}\cos\theta + \hat{x}\sin\theta) + (-\hat{z}\cos\theta + \hat{x}\sin\theta) \\ &\qquad +(\hat{z}\cos\theta - \hat{x}\sin\theta) \exp(-2ikz\cos\theta) - (\hat{z}\cos\theta - \hat{x}\sin\theta) \exp(2ikz\cos\theta)\} \\ &= \sqrt{\epsilon_o/\mu_o} E_o^2/2 \cdot 2\hat{x}\sin\theta = \hat{x}E_o^2\sin\theta/Z_o \text{ since the last line above is imaginary.}\end{aligned}$$

So, the average power moves in the $+x$ direction, proportionl to $\sin\theta$.