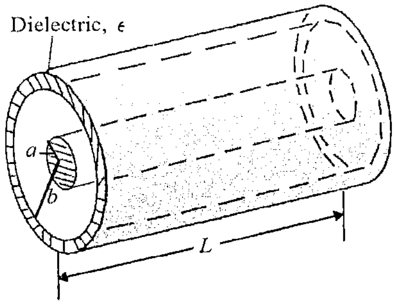
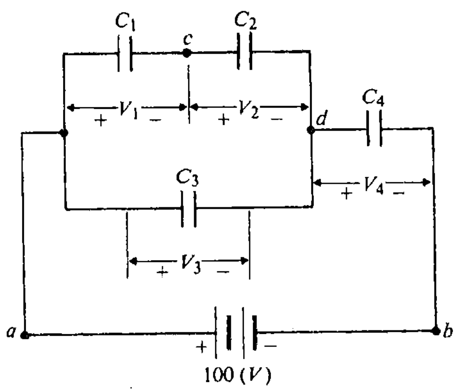
單選題，共二十題，每題5分。

1. (5%) A cylindrical capacitor consists of an inner conductor of radius **a,** and an outer conductor whose inner radius is **b**. The space between the conductors is filled with a dielectric of permittivity **ε**. The length of the capacitor is **L**. The capacitance of this this capacitor is
(A) C=2πεL/ln(b/a)　(B) C=2πεL/ln(a/b)
(C) C=2πεL/ln(ab)　(D) none of the mentioned



2. (5%) Four capacitance C_1=1(μF), C_2=2(μF), C_3=3(μF), C_4=4(μF), are connected as following figure. The total equivalent capacitance is
(A) 5.5 (μF) (B) 10 (μF) (C) 1.9 (μF) (D) none of the mentioned

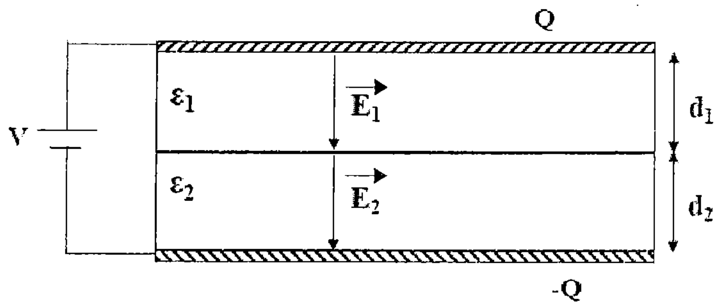


3. (5%) The Poisson's equation determines the relation of electric potential V, electric field $\vec{E}$, and charge density ρ. The correct Poisson's equation in simple medium is
(A) $\nabla^2 V=\nabla\cdot\vec{E}=\frac{\rho}{\varepsilon}$ (B) $-\nabla^2 V=\nabla\cdot\vec{E}=\frac{\rho}{\varepsilon}$
(C) $-\nabla^2 V=\nabla\cdot\vec{E}=\rho$ (D) $-\nabla^2 V=\nabla\cdot\vec{E}=Q$

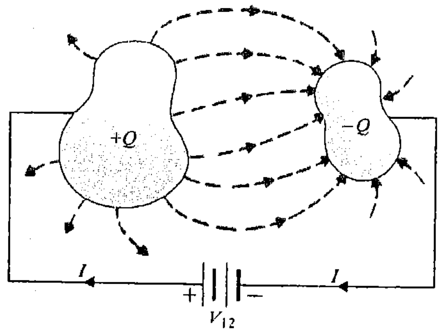
注意:背面有試題

4. (5%) The parallel-plate capacitor is shown in following figure. The electric field $\vec{E}_2$ is

(A) $\dfrac{V}{d_2+d_1\dfrac{\varepsilon_2}{\varepsilon_1}}$ (B) $\dfrac{V}{d_2+d_1\dfrac{\varepsilon_2}{\varepsilon_1}}$ (C) $\dfrac{V}{d_1+d_2\dfrac{\varepsilon_2}{\varepsilon_1}}$ (D) $\dfrac{V}{d_1+d_2}$



5. (5%) Two conductors in a simple lossy dielectric medium with ε&σ is shown in following figure. The RC product is
(A) 1/εσ (B) σ/ε (C) εσ (D) ε/σ



6. (5%) The fundamental postulates for magnetostatics state/infer:
(A)$\nabla\cdot\vec{H}=0$, (B) $\nabla\cdot\vec{J}=0$, (C) $\nabla\times\vec{B}=\vec{J}$, (D) None mentioned.

7. (5%) Ampère's Circuital Law is a powerful tool to determine the magnetic flux density, but why do we still need the Biot-Savart Law?
(A)Current may not form a closed loop in a problem,
(B) Current loop may have irregular geometry,
(C) Point of interest may not show symmetry,
(D) All above, (E) None mentioned.

8. (5%) The derivation of the Biot-Savart Law requires Coulomb gauge. Coulomb gauge states:
(A) $\vec{B}=\nabla\times\vec{A}$, (B) $\nabla\times\nabla\times\vec{A}=\mu_0\vec{J}$, (C) $\nabla\cdot\vec{A}=0$, (D) None mentioned.

9. (5%) If your eyes could see the fields of an electric dipole and a magnetic dipole, you would sense the field profiles are:
(A)Different near the dipoles, (B) Different far from the dipoles,
(C)Completely the same, (D) Completely different.

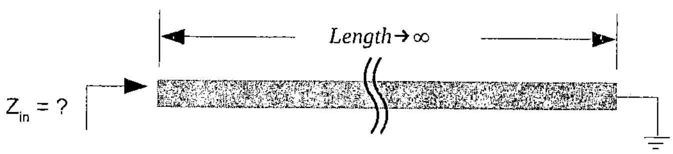
10. (5%) If we define β as the phase constant (also called the propagation constant), the group velocity is
(A) $\frac{\omega}{\beta}$, (B) $\frac{d\beta}{d\omega}$,
(C) $\frac{d\omega}{d\beta}$, (D) None of the above.

11. (5%) We define $\vec{P}=\vec{E}\times\vec{H}$, $w_e=(1/2)\epsilon|\vec{E}|^2$, $w_m=(1/2)\mu|\vec{H}|^2$, $p_\sigma=\sigma|\vec{E}|^2$. Which one of the following expressions is the correct Poynting's theorem?
(A) $-\oint_S \vec{P}\cdot d\vec{s}=\frac{\partial}{\partial t}\int_V (w_e+w_m)dv+\int_V p_\sigma dv$,
(B) $\oint_S \vec{P}\cdot d\vec{s}=\frac{\partial}{\partial t}\int_V (w_e+w_m)dv+\int_V p_\sigma dv$,
(C) $-\oint_S \vec{P}\cdot d\vec{s}=\frac{\partial}{\partial t}\int_V (w_e+w_m)dv-\int_V p_\sigma dv$,
(D) None of the above.

12. (5%) The **E**-field of a uniform plane wave propagating in a dielectric medium is given by
$\vec{E}(z,t)=\vec{a}_x\cos\left(2\pi 10^8 t-\frac{4\pi}{3}z+\frac{\pi}{6}\right)+2\vec{a}_y\sin\left(2\pi 10^8 t-\frac{4\pi}{3}z+\frac{\pi}{6}\right)(V/m)$. Assume this dielectric medium is lossless and non-magnetic ($\sigma=0$, $\mu_r=1$). Which of the following statements is correct?
(A) The dielectric constant ε_r of this medium is 4.
(B) This plane wave is linearly polarized.
(C) The wavelength in the dielectric medium is 6 m.
(D) None of the above.

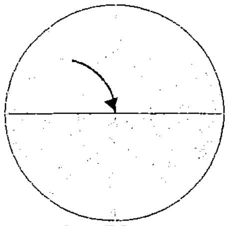
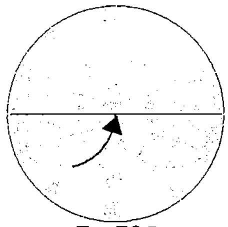
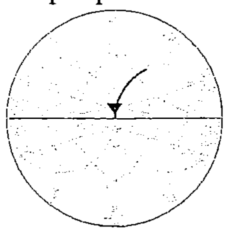
13. (5%) The instantaneous expression for the electric field of a uniform plane wave in vacuum is given by $\vec{E}(z,t)=E_0\vec{a}_x\cos(\omega t-k_0 z)$. We denote the intrinsic impedance of the free space by η_0. The magnetic field is
(A) $(E_0\cdot\eta_0)\vec{a}_y\cos(\omega t-k_0 z)$,
(B) $(E_0/\eta_0)\vec{a}_y\cos(\omega t-k_0 z)$,
(C) $(E_0/\eta_0^2)\vec{a}_y\cos(\omega t-k_0 z)$,
(D) None of the above.

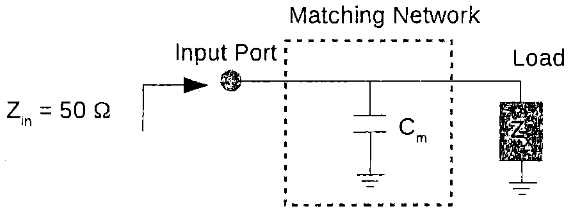
14. (5%) Assume there is a short end transmission line with infinite length as the figure shown below. The distributed parameters of the transmission line are ***R***=0.057(Ω/m) ,***L***=0.25(μH/m) ,***G***=22.8(μS/m) ,***C***=0.1 (nF/m). Please evaluate the input impedance Z_{in} at 1 GHz.
(A) 0.057 Ω (B) 2500 Ω (C) 50 Ω (D) None of the above.



注意:背面有試題

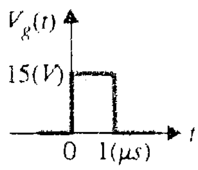
15. (5%) A matching network composed of an ideal shunt capacitor C_m transfers a load impedance of Z_x to input impedance of 50Ω, as the figure shown below. Please indicate which one is the possible changing procedure of reflection coefficient on a Smith Chart (Z-Chart) from load to input port while matching?

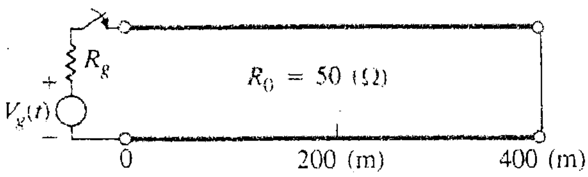
(A)  Z_0=50Ω , (B)  Z_0=50Ω ,(C)  Z_0=50Ω ,
(D)None of the above.



16. (5%) Given a 75-Ω characteristic impedance transmission line with length larger than the wavelength related to the sinusoidal input signal. Please evaluate the magnitude of the reflection coefficient $|\Gamma|$ on this transmission line terminated by an 50Ω load impedance.
(A) 0.385, (B)2.25, (C)0.2, (D)None of the above.

17. (5%) A rectangular pulse $V_g(t)$ of an amplitude 15 (V) and a duration 1(μs) is applied through a series resistance R_g of 25(Ω) to the input terminals of a 50(Ω) lossless transmission line. Given the speed of EM wave in this line is 1.5×10^8m/s. The line is 400 (m) long and short-circuited at the far end, as the figure shown below. Determine the voltage at the midpoint of the line at the time of 2 μs.
(A) 10V, (B)-10V, (C)0V, (D)None of the above.





18. (5%) In an air-filled metallic rectangular waveguide, which of the following will be the most likely answer for the fundamental mode?
(A) TE_{11} (B) TM_{10} (C) TE_{10} (D) TEM

19. (5%) The fundamental mode propagating in the Teflon-filled parallel plates will be
(A) TE_2 (B) TE_1 (C) TM_1 (D) TEM

20. (5%) The cutoff frequency for the TM_3 mode in the air-filled parallel plates (with separation of 1 cm) will be somewhere in the frequency range of
(A) DC~20 GHz (B) 20~40 GHz (C) 40~60 GHz (D) 60~80 GHz