UNIVERSITY OF SRI JAYEWARDANEPURA
FACULTY OF APPLIED SCIENCES

B. Sc. General/Special Degree Third Year Second Semester Course Unit Examination

March, 2021

DEPARTMENT OF PHYSICS

PHY 329 1.0 / PHY 373 1.0 – Space Physics

Time : One hour

No of Questions : 03

No of Pages : 02

Total marks : 60

Answer all questions

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01. **You are given** the resonance frequency f_p of the plasma oscillations of an ionized electrically neutral medium containing free charges of mass m is $f_p = \frac{e}{2\pi}\left(\frac{N}{\varepsilon_o m}\right)^{1/2}$. Where, N is the number density of free charges, $\varepsilon_o = 8.85\times10^{-12}\ Fm^{-1}$ and $e = 1.6\times10^{-19}\ C$.

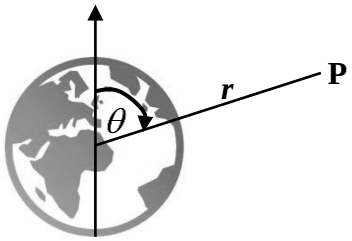
(a) Estimate the highest frequency that can be reflected from the ionosphere at normal incidence if the maximum electron density in the ionosphere is $2.0\times10^{12}\ m^{-3}$. (Mass of the electron is $9.1\times10^{-31}\ kg$)

(b) Which of the following radio wave bands get reflected from the ionosphere at normal incidence?

Band	Frequency Range
VLF	3 kHz – 30 kHz
LF	30 kHz – 300 kHz
MF	300 kHz – 3 MHz
SW	3 MHz – 30 MHz
VHF	30 MHz – 300 MHz
UHF	300 MHz – 3 GHz

(20 Marks)

02.



You are given the following mathematical equation for the Earth magnetic field intensity, $H(r,\theta)$ at any point P at a distance r from the center of the Earth and making an angle θ with the vertical, as shown in the figure above.

$$H(\ r,\ \theta\ ) = \frac{\mu_o}{4\ \pi} \cdot \frac{M}{r^3} \cdot \left(\ 1 + 3\ \cos^2\theta\ \right)^{1/2}$$

Where, M is the Dipole Moment of the Earth and the other symbols have their usual meanings.

(a) The intensity of the Earth's Magnetic Field at the equator is *40,000 nT*. **Calculate** the Dipole Moment of the Earth.

($\mu_0 = 45\times10^{-7}\ Nm^2wb^{-2}$ and the radius of the Earth is $6.4\times10^6\ m$)

(b) Hence, **determine** the Earth's Magnetic Field intensity at the poles of the Earth.

(20 Marks)

03. ***(a)*** Explain how does the apparent solar disc has a "well defined boundary" even through the Sun is not a solid body.

(b) Describe how would you use the Wien's Displacement Law,

$$\lambda_{\max} \cdot T = \frac{hc}{5k} \approx 2.897\times10^{-3}\ m\ K$$

to calculate approximate average temperatures of the apparent solar disc and the other regions of the Sun. (All the symbols have their usual meanings).

(20 Marks)

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