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BS Physics

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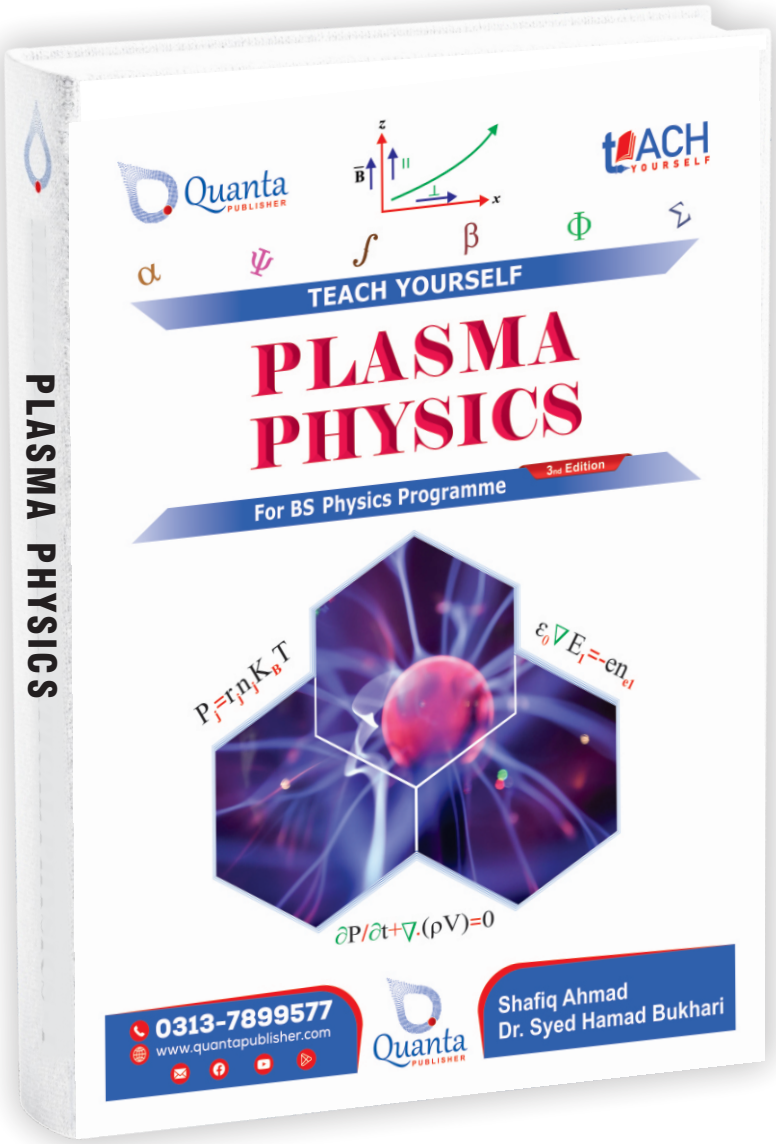

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SHAHEED BENAZIR BHUTTO UNIVERSITY SHERINGAL
BS Spring Semester Examinations 2021

Subject: Plasma Physics

BS Physics (8th semester)

Time Allowed: 03 Hours **Maximum Marks: 80**

Note Please: Possession, use of Mobile phone and other electronic devices which can be helpful in examination are strictly prohibited in the examination hall and can lead to the cancellation of paper and examination on report.

Paper Instructions: Attempt any five questions. All questions carry equal marks.

Q.1 (a) Define and explain Debye shielding. Prove that the shielding distance of shield is equal to $(\varepsilon_o KTe/e^2 no)^{1/2}$ (8)

(b) Compute λ_D and N_D for the glow charge with $n=10^{16}\ m^{-3}$ and KTe =2ev (8)

Q.2 (a) Explain the motion of charge particles in the uniform electric field while magnetic field is zero (8)

(b) An ion engine has a 1 Tesla magnetic field and a hydrogen plasma is to be shout out at an E*B velocity of 1000 km/s. How much internal electric field must be present in the plasma? (8)

Q.3 (a) Derive plasma frequency relation $W_p = (n_o e^2/\varepsilon_o m)^{1/2}$

(b) Electron plasma waves are propagated in a uniform plasma with *KTe = 100ev, n=10^16 m^-3*, B=0, if f = 1.1Ghz, what is the wavelength in cm? (8)

Q.4 How can one relate B, H and M in a magnetized material. Establish the relation between these quantities in plasma? (8)

Q.5 (a) Use continuity equation coupled with momentum equation and with Maxwell,s equation derive the relation for plasma frequency i.e. $Wp = (noe^2/\varepsilon_o ne)^{1/2}$ (8)

(b) Explain validity of the plasma Approximation? (8)

Q.6 (a) Explain with one example the convective derivative? (8)

(b) Show that in the expression i.e. $J_D = (KTi+KTe)\ B^* \nabla/B^2$ the right side of the equation has the dimension of current density (8)

Q.7 (a) Explain fluid drifts parallel to "B"? (8)

(b) What is TOKAMAK?

Q.8 (a) Show that $W_L = (Wc\ .\ \Omega)^{1/2}$ where Wc is the lower hybrid frequency (8)

(b) For electromagnetic waves, show that the index of refraction is equal to the square root of appropriate plasma dielectric constant, ε ? (8)

GOVERNMENT COL...

GC UNIVERSITY, FAISALABAD

Final Semester Examination M. Sc. 4th (Spring 2019) Total Marks = 30

Course: Plasma Physics

Time: 2½ hrs Code: PHY-652 Roll No: 129807

SUBJECTIVE PART

Note: All questions are compulsory and each question carries equal marks!

Q:2-

i) Plasma is a diamagnetic material, Justify it.

ii) Define the term Debye shielding.

iii) Define the term "magnetic drift of charge particles". (2+2+2)

Q:3- Describe the dynamics of charge particles in the uniform, static external electric and magnetic fields. Furthermore also derive the expression of $\vec{E} \times \vec{B}$ drift. (6)

Q:4-

i) An interplanetary space is so rare that it has only one charge particle in a Volume of one centimetre cube ($n = 1\ cm^{-3}$) and its temperature is 0.01 ev. Specify whether it is plasma or not?

ii) Define the terms plasma Frequency, and Larmor radius. (3+3)

Q:5- Consider a situation in which magnetic field is inhomogeneous along the magnetic field Direction, and discuss the motion of a charge particle in this configuration of the magnetic field and prove that the force acting on the particle in antiparallel to grad-B direction is mathematically given as

$$\vec{F}_{||} = -\mu \vec{\nabla}_{||} B$$

Where μ is magnetic moment of the gyrating particle. (6)

Q-6:-

i) Specify the frequency of electromagnetic waves which cannot propagate in the unmagnetized electron plasma?

ii) Define cut off density the plasma and determine its expression for the electromagnetic waves of frequency ω?

iii) Prove that unmagnetized electron plasma is rare than vacuum.

Whereas the dispersion relation of electromagnetic waves propagating in unmagnetized electron plasma is given as $\omega^2 = \omega_{pe}^2 + c^2 k^2$ (2+2+2)