Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 11

M.Sc. (Physics) (Campus) (2016 Onwards)   (Sem.–3)

PLASMA PHYSICS

Subject Code : PHS-536

M.Code : 51227

Time : 3 Hrs.   Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :
1. **Section-A is compulsory consisting of TEN questions carrying TWO marks each.**
2. **Section-B contains SEVEN questions carrying FIVE marks each and students have to attempt any SIX questions.**
3. **Section-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. **Answer briefly :**   2×10=20

a. Give two examples each of naturally existing and artificially created plasmas.

b. State Paschen's law of gas breakdown.

c. Make a comparison in terms of advantages between electrostatic probes, magnetic probes and optical diagnostics of plasma.

d. Draw the V-I characteristics of plasma using single electrostatic probe, explain each section.

e. Differentiate between the Larmour radius and Cyclotron frequency for an electron and proton moving in a uniform magnetic field.

f. Mention different types of oscillations/waves possible in plasma and write their dispersion relations.

g. Write the macroscopic parameters of plasma.

h. Differentiate between cold and hot plasmas.

i. Differentiate between two-stream instability and gravitational instability in plasma.

j. Write the Vlasov equation for plasma and give its properties.

SECTION-B

Q2. Define plasma state of matter and explain its characteristics.   5

Q3. Explain the breakdown of gases, breakdown potential and different regimes in a discharge.   5

Q4. Describe the double probe technique for plasma diagnostics, draw its circuit diagram, explain working/procedure and V-I characteristics with due explanation to each portion of the curve.   5

Q5. Using appropriate equations of motion for a particle in a varying magnetic field, derive the expression for the average force acting on the particle as well as magnetic moment of the particle.   5

Q6. Discuss all the following fluid equations of motion and their version for plasma :   5

   i) Equation of motion

   ii) Equation of continuity

   iii) Equation of state

Q7. Define plasma oscillations, explain their origin and derive the expression for plasma frequency of the wave using appropriate wave equations.   5

Q8. Explain how plasma is supported against gravity by magnetic field.   5

SECTION-C

Q9. Discuss the Townsend's theory of collision by ionization leading to the breakdown of gas.   10

Q10. Using appropriate equation of motions, derive the expression of polarization drift velocity and polarization current for a charged particle in a time-varying electric and uniform magnetic field.   10

Q11. What are the parametric instabilities in plasma? Explain their types like : coupled oscillators, frequency matching.   10

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.