Seat No. : _____

# LF-111

April-2014

B.Sc. (Sem.-VI)

CC-309 : Physics

Time : 3 Hours] [Max. Marks : 70

1. (A) મેક્સવેલ સમીકરણ આપો અને સાતત્ય સમીકરણ મેળવો અને તે ચાર્જ સંરક્ષણ કેવી રીતે વ્યક્ત કરે છે ? સમજાવો. 7

Giving Maxwell's equation, derive the equation of continuity and explain how it expresses conservation of charge.

અથવા/OR

સમાન ચુંબકીય ક્ષેત્રમાં ગતિશીલ ચાર્જ કણ માટે ગાઈરો ત્રિજ્યા અને ગાઈરો-ફ્રિકવન્સીના સમીકરણો મેળવો.

Derive the equations for gyro-radius and gyro-frequency of a charged particle, moving in uniform magnetic field.

(B) સતત વિદ્યુત અને ચુંબકીય ક્ષેત્રમાં ગતિશીલ ચાર્જ કણની ગતિ સમીકરણ આપતાં ડ્રિફ્ટ વેગના સમીકરણ મેળવો અને તેનો ભૌતિક અર્થઘટન કરો. 7

Giving equation of motion of a charged particle in constant electric and magnetic field, obtain equation of drift velocity and discuss physical interpretation of it.

અથવા/OR

Converging ચુંબકીય ક્ષેત્ર કેવી રીતે ચુંબકીય દર્પણ જેમ કામ કરે છે ? બતાવો.

Show how a converging magnetic field acts like a magnetic mirror ?

2. (A) પ્લાઝમા આવર્તનોની પદ્ધતિ આપો અને પ્લાઝમા આવૃત્તિ માટે સમીકરણ મેળવો. 7

Give the mechanism of plasma oscillations and derive the expression for plasma frequency.

અથવા/OR

પ્લાઝમાની ધ્રુવીકરણતા સમજાવો અને સતત લાગુ ચુંબકીય ક્ષેત્ર માટે વિક્ષેપ (Dispersion) સંબંધો અને Phase વેગ મેળવો.

Explain Polarisability of plasma and obtain the dispersion relations and phase velocity for steady applied magnetic field.

(B) Plasma Sheath સમજાવો અને જરૂરી સમીકરણો મેળવો. 7

Explain plasma sheath and derive necessary equation.

**અથવા/OR**

Debye Screening આપો અને સમજાવો તથા Debye Lengthનું સમીકરણ મેળવો.

Give and explain modal for Debye screening. Also derive the expression for Debye Length.

3. (A) Mossbauer અસર કેવી રીતે વાપરી શકાય છે ? 8

Explain how Mossbauer effect can be used to :

(i) ગુરૂત્વાકર્ષણ રેડ શિફ્ટ માપવામાં.

Measure the gravitation red shift.

(ii) *hf* સંપર્કના અભ્યાસમાં

Study the *hf* interaction.

**અથવા/OR**

*Four-factor formula* તારવો.

Deduce *four-factor formula.*

(B) કુદરતી ફ્યુઝન અને નિયંત્રિત ફ્યુઝન શક્યતા ઉપર નોંધ લખો. 6

Write note on : Natural fusion and possibility of controlled fusion.

**અથવા/OR**

ઉદાહરણ સાથે અસમપ્રમાણતાવાળા વિખંડન-માસ ઉપજ સમજાવો.

With illustration explain *asymmetrical fission-mass yield.*

4. (A) મૂળભૂત કણોનું વર્ગીકરણ કરો. 8

Classify elementary particles.

**અથવા/OR**

સમજાવો : ચાર ''ળભૂત બળો.

Explain : Four basic forces

(B) સમજાવો : મેસોન અને બેરીઓનની કવાકર્સ રચના. 6

Explain : Quark structure of mesons and baryons.

**અથવા/OR**

સમજાવો : સ્ટાન્ડર્ડ મોડલ

Explain : Standard model.

5. જણાવ્યા મુજબ કરો : 14

Do as directed :

(1) મૅગ્નેટો પ્લાઝમામાં પ્રસરણના રોલ શું છે ?

What is the roll of diffusion in the magneto plasma ?

(2) ઈલેક્ટ્રોસ્ટેટિક અને ઈલેક્ટ્રોમેગ્નેટિક કંપન વચ્ચે શો તફાવત છે ?

What is the difference between electrostatic and electromagnetic oscillation ?

(3) Boltzmann H-પ્રમેય લખો.

State Boltzmann H-theorem.

(4) Pinch અસર એટલે શું ?

What do you mean by Pinch effect ?

(5) Alfven વેગ, $V_A$ ના સમીકરણ આપો.

Give the equation of Alfven velocity $V_A$.

(6) મૅગ્નેટો-પ્લાઝમા એટલે શું ?

What do you understand by magneto-plasma ?

(7) એક Assembly ની સુપર જટિલ કદ સ્થિતિ આપો.

Give the condition of super-critical size of an assembly.

(8) $^{235}U$ ના વિખંડન દીઠ પ્રકાશિત ઊર્જાનો જથ્થો આપો.

Give the amount of energy released per fission of $^{235}U$.

(9) રાસાયણિક શિફ્ટ એટલે શું ?

What do you understand by chemical shift ?

(10) Larmor પ્રમેય શું છે ?

What is Larmor theorem ?

(11) 'Antiparticles' એટલે શું ?

What do you understand by 'Antiparticles' ?

(12) ઉતરતા ક્રમમાં મૂળભૂત ક્રિયાપ્રતિક્રિયા ગોઠવો.

Arrange fundamental interaction in descending order.

(13) પૂર્ણ કરો : $\pi + p \rightarrow \pi + p +$ _____ + _____.

Complete the following : $\pi + p \rightarrow \pi + p +$ _____ + _____.

(14) 'Graviton' એટલે શું ?

What do you understand by Graviton.

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Seat No. : _____

# AE-110

**April-2015**

**B.Sc., Sem.-VI**

**Phy-309 : Physics**

**Time : 3 Hours]** **[Max. Marks : 70**

1. (a) Discuss the motion of charged particle in uniform magnetic field and obtain the formulae for Larmor radius and Larmor frequency. 7

**OR**

Show that the mechanical energy of a particle remains constant when it is moving in mutually perpendicular and uniform $\vec{E}$ and $\vec{B}$ fields. Also show that $\vec{E}$ and $\vec{B}$ fields are constant.

(b) Explain the motion of a particle moving with velocity $\vec{V}$ in the perpendicular $\vec{E}$ and $\vec{B}$ fields and obtain the equation for its drift velocity $\vec{V}_D = \frac{\vec{E}\times\vec{B}}{B^2}$. 7

**OR**

Explain how a converging magnetic field acts like a magnetic mirror.

2. (a) What is plasma ? Explain properties and force acting on the plasma when the magnetic field is applied to the plasma. 7

**OR**

Obtain Maxwell's equation in Homogeneous plasma.

(b) Obtain dispersion relation for transverse oscillations incase of steady applied magnetic field $\vec{B} = 0$ to the plasma. Derive the relation of group velocity, Vg and phase velocity, (Vph). 7

**OR**

Derive the Boltzman equation for the kinetic theory of plasma and explain physical meaning of each term.

3. (a) Explain fission chain reaction. 7

**OR**

(i) Give a full account of nuclear reactors.

(ii) If energy released per fission of $U^{235}$ nucleus is 200 MeV, calculate energy released from 50 gm of $U^{235}$.

(b) Explain NMR 7

**OR**

Explain Mossbauer effect with an experiment.

4. (a) Explain the three families of material particles. 8

**OR**

Explain with examples : Lapton number conservation, Baryon number conservation and Strangeness number conservation.

(b) (i) List some similarities and differences between properties of photons and neutrinos. 6

(ii) Write note on antiparticles.

**OR**

Explain : Quark model.

5. Do as directed : 14

(i) Find the velocity of Alfvén wave in mercury in magnetic field of $B = 10^{-2}$ Tesla. ($\rho = 13.6 \times 10^3$ kg m$^{-3}$ and $\mu_0 = 4\pi \times 10^{-7}$ N/A$^2$)

(ii) What do you mean by Pinch effect ?

(iii) What will be the plasma frequency and the corresponding wavelength for laboratory plasma with number density $10^{18}$ m$^{-3}$ ?

(iv) What do you understand by electric drift velocity ?

(v) What do you understand by isobaric surface ?

(vi) What is magneto plasma ?

(vii) Define : Dispersion relation.

(viii) Define : Nuclear fusion.

(ix) What do you understand by mirror nuclei ?

(x) What is the role of catalyst in carbon cycle ?

(xi) What is Larmor theorem ?

(xii) Give the equation for available energy Q for the decay.

(xiii) Give the missing particle in following decay :

$\pi^- \rightarrow \mu^- +$ _____.

(xiv) The strong force between quarks is carried by particles called _____.

Seat No. : _____

# AD-109

April-2016

B.Sc., Sem.-VI

CC-309 : Physics
(Theory)

Time : 3 Hours] [Max. Marks : 70

**Instructions :** (1) Symbols bear the usual meaning.
(2) Each question carries equal marks.
(3) Draw a diagram where necessary.

1. (a) Write Maxwell's equations and using them, obtain the equation of continuity. 7

**OR**

Discuss the motion of a charged particle in uniform magnetic field and obtain the equation for Larmor radius and Larmor frequency.

(b) Solve the equations of motion for a single charged particle in constant homogeneous fields $\vec{E}$, $\vec{B}$. Show that the particle exhibits drift velocity $V_D = (\vec{E} \times \vec{B}) / B^2$. Give the physical interpretation of electric drift. 7

**OR**

Explain how a converging magnetic field acts like a magnetic mirror.

2. (a) Discuss oscillations and waves in plasma and explain Langmuir oscillation. 7

**OR**

Discuss alternative methods of derivation of plasma frequency.

(b) Obtain Maxwell's equations in homogeneous plasma. 7

**OR**

Obtain Fokker-Plank equation by test particle theory.

3. (a) Obtain the 'Four Factor Formula' $K\infty = \eta\varepsilon pf$ with reference to Fission chain reaction. 7

**OR**

Give a detailed account of Nuclear reactor and also discuss the energy released during the fission of a $U^{235}$ nucleus.

(b) Explain Mossbauer Effect and describe one experiment regarding it. 7

**OR**

Explain the process of Fusion and also describe the Carbon cycle.

4. (a) Describe in detail the four fundamental forces. 7

**OR**

Write a note on particle and antiparticle.

(b) Write a note on Lepton family and explain Lepton number conservation. 7

**OR**

Explain the Quark model in detail.

5. Answer the following questions : 14

(1) What is Pinch effect ?

(2) What is magneto plasma ?

(3) What is Larmor Frequency ?

(4) Write Langevin's equation.

(5) What are Alfven waves ?

(6) Define Debye length.

(7) Define Dispersion relation.

(8) Write the names of any two moderators.

(9) What are 'prompt' neutrons ?

(10) For a fission chain reaction, write the outcome of $K < 1$ & $K > 1$.

(11) Write the law of conservation of strangeness.

(12) Write the names of families of particles.

(13) $\pi^- \rightarrow \mu^- + \xrightarrow{?}$

(14) What is nuclear fission ?

Seat No. : _____

# AI-106

April-2017

B.Sc., Sem.-VI

CC-309 : Physics

Time : 3 Hours] [Max. Marks : 70

**Instruction :** Symbols bear the usual meaning.

1. (a) Obtain the expression for gradient drift velocity $v_G$ and current density for a charged particle moving in inhomogeneous magnetic field. 7

**OR**

(i) Prove that the work done on the particle by external field through the Polarization process is equal to the change in K.E of particle due to electric drift. 4

(ii) Obtain adiabatic space invariance of magnetic moment of charged particle when change in magnetic field is small over Lamoure radii. 3

(b) Explain how the converging magnetic field acts like a mirror. Discuss magnetic trap double mirror and trap cones. 7

**OR**

(i) An electron is moving with 4 KeV energy in earth's magnetic field of 0.36 gauss, then find the Lamoure radius.
$e = 1.6 \times 10^{-19}$ C, $m = 9.1 \times 10^{-31}$ kg. 4

(ii) Find the cyclotron frequency of an electron moving in magnetic field of 1 T. 3

2. (a) Write Maxwell's equations and derive the dispersion relation, group velocity and phase Velocity for transverse oscillations for $B_a = 0$ and $\epsilon \neq 0$. 7

**OR**

(i) Using Langvins equation, show that the average velocity of an electron approaches to zero at the rate of collision frequency in the absence of external forces. 4

(ii) Waves are incident on a slab of plasma at an angle $\theta$. The plasma has a frequency $\omega_p$ and the dispersion relation is $\omega^2 = \omega_p^2 + c^2k^2$. Using Snell's law, find the Critical angle $\theta_c$ for total internal reflection as a function of frequency. 3

(b) What is Debye length ? Derive it by statistical mechanics and prove that $\lambda_D = \frac{\lambda_{De}}{\sqrt{2}}$. 7

**OR**

(i) Discuss diffusion of plasma particles in magnetic field. Which particle move faster in parallel diffusion ? Which particle escapes more slowly in transverse diffusion ? 4

(ii) A solar corona consists of ionized hydrogen of particle density of about $10^{12}$ $m^{-3}$. Assuming the magnetic field in corona to be $10^{-3}$ T. Compute the phase velocity of Alfven waves. $M_H = 1.6 \times 10^{-27}$ kg. $\mu_0 = 4\pi \times 10^{-7}$ MKS 3

3. (a) Explain neutron induced nuclear fission in detail. 2\0 6

**OR**

Explain nuclear fusion process occurring in stars. 3\1

(b) Explain neutron cycle and derive four factor formula $K_{\infty} = \eta \varepsilon p f$ 220 8

**OR**

What is Mossbauer Effect ? Explain experimental arrangement of Mossbauer Effect. 306

4. (a) Explain classification of elementary particles. 6

**OR**

Explain Quarks model of elementary particles.

(b) Describe in detail about four basic forces. 8

**OR**

Describe law of conservation of Lepton number and Baryon number for elementary particles.

5. Answer the following Questions : 14

(1) Compare the equation of Alfven velocity with wave propagating along string.

(2) Write the unit of mobility of plasma particle.

(3) Name different types of collision between particles in plasma.

(4) Why the temperature of electron gas is higher than ion gas ?

(5) Write the equation of Debye potential.

(6) What is magneto plasma ?

(7) Name different types of waves produce in plasma.

(8) How much energy is released in fission of $_{92}U^{235}$ nucleus ?

(9) Give statement of law of conservation of strangeness.

(10) Define Spallation reaction.

(11) Why are neutron used as bombarding agents in nuclear physics ?

(12) What is Gluon ?

(13) Define delayed neutrons.

(14) What is the value of spin of meson ?

Seat No. : 8575

# AC2-03

**April - 2018**

**B.Sc., Sem.-VI**

**CC-309 : Physics**

**Time : 3 Hours]** **[Max. Marks : 70**

**Instruction :** Symbols bear their usual meaning.

1. (a) Explain the motion of charged particle in uniform magnetic field and obtain Lamour radius and cyclotron frequency. Also prove that total K.E remains constant. 7

**OR**

Obtain the expression for polarization drift velocity $v_p$, for a charged particle moving in time dependent electric field and uniform magnetic field.

(b) Obtain the expression for curvature drift velocity $v_R$ and current density for a charged particle moving in inhomogeneous magnetic field along the curved lines of force with parallel component of velocity. 7

**OR**

Explain how the converging magnetic field acts like a magnetic mirror.

2. (a) Explain longitudinal plasma oscillations and derive expression for plasma frequency. 7

**OR**

Derive Maxwell's equations for homogeneous plasma.

(b) What is Debye length ? Derive it by dimensional analysis. 7

**OR**

Derive the Boltzmann equation and give the physical significance of this equation.

3. (a) What are prompt and delayed neutrons ? Explain important role played by the delayed neutron in nuclear reactions. 7

**OR**

Discuss any two applications of Mossbauer effect.

(b) What is Mossbauer effect ? Describe an experiment for study of Mossbauer effect. 7

**OR**

Explain asymmetrical nuclear fission. Sketch the mass distribution of fission fragments for different fission chain of it. Define fission yield.

4. (a) Discuss in detail about particles and anti-particles. 7

**OR**

Explain law of conservations of Lepton number.

(b) Describe about the standard model for elementary particles. 7

**OR**

Write note on Leptons and Mesons.

5. Answer all questions in short : 14

(i) What is head on collision for Charged Particles ?

(ii) What is the use of magnetic field for plasma ?

(iii) Write equation of Alfevan velocity ?

(iv) What is Debye potential ?

(v) Write ohms law for plasma.

(vi) Name three plasmas on earth planet.

(vii) Write the equation of magneto hydrodynamics.

(viii) Define thermal neutrons.

(ix) Define homogeneous reactor.

(x) On which factor does the power level at which reactor operate depend ?

(xi) Define breeding process.

(xii) How nuclear reactor can be shut down ?

(xiii) Define red shift.

(xiv) Define spallation reaction.

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