

St. Philomena's College(Autonomous), Mysore

Question Bank

Programme: M.Sc. Physics

IV Semester

Course Title: Accelerator Physics

Course Type: Soft Core

Q.P Code : 58302

Sl. No	Questions	Marks
	UNIT I	
1.	List the properties of an ion sources.	5
2.	Explain the electron and ion impact ionization.	6
3.	With a neat labelled diagram, describe the working of discharge type ion sources for positive ions.	6
4.	Explain with a neat labelled diagram diagram the ion sources for a cyclotron.	6
5.	Discuss in detail the ion sources for negatives ions.	6
6.	With a neat labelled diagram explain how low voltage sources are used to produce atomic and molecular ions.	6
7.	Describe how ions are produced using radio frequency source.	6
8.	Explain in detail thermal ionization and thermionic emission process.	6
9.	Analyze the need for electrostatic and magnetic lenses. Explain how they differ from optical lenses.	6
10.	Explain with a neat labelled diagram the ion sources for a cyclotron.	8
11.	Discuss in detail the semi classical treatment of ionization.	8
12.	Obtain the condition for spark using the breakdown mechanism.	8
13.	Obtain the condition for spark using the breakdown mechanism.	8
14.	Explain the process of insulation at high voltages with suitable example.	8
15.	Analyze the focusing properties of linear fields.	9
16.	Describe how Electrostatic lenses are used focus ions from an ion sources.	9
17.	Define Townsend's first ionization coefficient and obtain an expression for the same.	10

18.	Explain the source of secondary ions in Townsend's experiment and discuss how they mathematically incorporated in theory.	10
19.	Explain the need for a second ionization coefficient in Townsend's theory and hence obtain an expression for the same.	10
20.	With necessary theory explain Paschen's law for gaseous breakdown and obtain the expression for sparking voltage.	10
21.	Explain with a neat labelled diagram the construction and working of a magnetic lens to focus the ions from an ion source.	12
UNIT II		
22.	What are electrostatic accelerators? Explain how they are used to accelerate charged particles.	4
23.	List the advantages and disadvantages of Van-de-Graff generator.	4
24.	List the advantages and disadvantages of Cockroft-Walton generator.	4
25.	Discuss the merits and demerits in placing the ion source at high voltage dome.	4
26.	List the difference between Tandem and Pelletron accelerators.	4
27.	Explain how a high value of DC voltage can be generated using capacitors and diodes from the output of a transformer.	5
28.	What are Pelletron accelerators? Discusses their advantages.	6
29.	Distinguish between cyclic and linear accelerators.	6
30.	Explain why the length of the drift tubes are greater than its preceding one.	6
31.	With necessary theory explain the construction and working of drift tube accelerators.	6
32.	Electrons cannot be accelerated using drift tube accelerators'. Justify your answer and explain the construction and working of electron LINAC.	8
33.	Give the basic principle of Vande Graff generator. Explain its Construction and Working.	9
34.	With necessary theory and a neat labelled diagram describe the construction and working of Cockroft-Walton generator.	10
35.	Explain the working of Tandem type Pelletron accelerators.	10
36.	Explain the principles of uniform field cyclotron.	10

37.	Give the difference between Vande Graff generator and tandem accelerator and explain the working of Tandem accelerators.	12
38.	Obtain an expression for the resonance frequency of a cyclotron.	12
39.	Discuss the Longitudinal dynamics of the uniform-field cyclotron	12
40.	Obtain an expression for the lengths of the drift tubes of a Linear accelerator at non-relativistic and relativistic speeds of an ion.	12
	Unit III	
41.	Discuss the upper limit of energy of the electrons accelerated by betatrons and obtain the expression for energy loss per turn.	6
42.	With neat diagram explain the microtron working principle.	6
43.	Draw the schematic diagram of (i) proton synchrotron assembly (ii) C-section and H-section magnet.	6
44.	Explain the principle of betatron and deduce the betatron condition.	8
45.	Explain the working principle of electron synchrotron.	8
46.	Illustrate the overall effect of AG focussing with neat diagram.	8
47.	Explain the application of quadrapole magnets in AG Synchrotrons.	8
48.	Discuss the construction and working of betatron and show that final kinetic energy of the electron is inversely proportional to radius of the electron orbit.	10
49.	Discuss phase stability in the synchrotron.	10
50.	Discuss alternating gradient (AG) focussing (or method of strong focussing.	10
51.	Briefly explain (i) AG electron synchrotron (ii) Heavy ion synchrotron.	10
52.	Discuss the energy relations in microtron.	12
53.	Explain the working principle of proton synchrotron.	12
54.	Explain betatron oscillations.	12