

**Final Year B.Sc., Degree Examination**  
**August/Semptember 2010**  
**DIRECTORATE OF CORRESPONDENCE COURSE**  
**PHYSICS (Freshers)**

**Paper - III: MODERN PHYSICS I**  
**SPECTROSCOPY, WAVE MECHANICS STATISTICAL MECHANICS,**  
**RELATIVITY AND ASTRO PHYSICS**

Time: 3 hrs]

[Max.Marks: 85

**Instruction:**

1. Answer all questions in Section – A in the first two pages of the main answer book.
2. Answer any **FIVE** questions from Section – B, any **SEVEN** questions from Section – C and any **TWO** questions from Section – D.
3. Draw neat labeled diagrams wherever necessary.
4. Take the necessary data from the tables.

**SECTION – A**

**I. Answer ALL the questions:**

8 X 1 = 8 Marks

1. State Duane – Hunt rule.
2. State selection rules for spectral transitions.
3. What is stark effect?
4. What is minkowski world?
5. What is Halography?
6. What is ESR?
7. State Hubble's law.
8. What is Chandrashekhar limit?

**SECTION – B**

**II. Answer any FIVE questions:**

5 X 3 = 15 Marks

9. Explain the variation of Rydberg constant with the finite mass of the nucleus.
10. State and Explain pauli's exclusion principle.

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11. State and Explain Moseley law.
12. Derive an expression for de Broglie wave length of matter waves.
13. State and explain Heisenberg uncertainty principle.
14. Give the difference between inertial mass and gravitational mass.
15. Write a note on Black hole.

**SECTION - C****III. Answer any SEVEN questions:**

7 X 6 = 42 Marks

16. Explain Length contraction and time dilation.
17. With a neat diagram and relevant theory describe Thomson's method of determining the specific charge of an electron.
18. Give quantum mechanical explanation of normal Zeeman effect.
19. Mention the characteristics of characteristic x – rays.
20. Give the theory of Compton effect.
21. Describe the construction and working of a He – Ne laser with the help of energy level diagram.
22. With relevant theory explain Davisson and Germer's experiment to substantiate the concept of matter waves.
23. Obtain the Schrodinger's equation for a particle in a one dimensional box and solve it to obtain the energy eigen values.
24. What is H.R diagram? Explain it in detail.

**SECTION - D****IV. Answer any TWO questions:**

2 X 10 = 20 Marks

25. a) Obtain the Schrodinger's time dependent equation for a free particle. **6 Marks**  
b) A microscope using photons is employed to locate an electron in an atom with in a distance of  $0.1 \text{ \AA}$ . Calculate the uncertainty in the momentum of electron. **4 Marks**
26. a) Derive Planck's law from B – E statistics. **6 Marks**  
b) An electron is constrained in a one dimensional box of side  $1 \text{ nm}$ . Obtain the first three eigen values in e.v. **4 Marks.**

*Contd.....3*

27. a) Deduce Einstein's mass-energy relation. **6 Marks**  
b) A clock keeps correct time. With what speed should it be moved related to an observer so that it may seem to lose one minute in one day. **4 Marks**
28. a) Write a note on Stellar magnitude and hence state mass luminosity relation. **6 Marks**  
b) Mention any four applications of NMR. **4 Marks**

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