2006

PHYSICS - II (Optional)

000064

Standard : Degree

Total Marks : 200

Nature : Conventional

Duration : 3 Hours

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Make suitable assumptions, wherever be necessary and state the same.*

(v) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vi) *Credit will be given for orderly, concise and effective writing.*

(vii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he will be penalised.*

(viii) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. ***Answer any four of the following questions :***

(a) What do you mean by hysteresis ? Show that hysteresis loss is equal to the area enclosed by hysteresis loop in taking the sample round one cycle. **10**

(b) Explain in brief *'failure of classical physics'*. **10**

(c) What are LASER's ? State different applications of LASER's. **10**

(d) What do you mean by Global Positioning System (GPS) ? Explain. **10**

(e) State various applications of Geostationary Satellites. Explain in brief the application of geostationary satellite in transmission of television programming. **10**

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Marks

SECTION - A

2. *Answer the following sub-questions :*

(a) Obtain the solution of Laplaces equation in rectangular co-ordinate system. **10**

(b) State and explain Kirchhoff's laws. If P, Q and R are known resistances in Wheatstones Bridge, then how will you determine fourth unknown resistance S in the bridge ? **15**

(c) State four basic experimental laws of electrodynamics and explain how they are modified to obtain Maxwell's equations. **15**

3. *Answer the following sub-questions :*

(a) Explain method of electrical images with any one application. **10**

(b) With neat diagram, explain the principle of working of the transformer. What are different energy losses ? State any three applications of transformer. **15**

(c) What is Poynting Vector ? Show that the surface integral of the Poynting Vector measures the rate of flow of electromagnetic energy. **15**

SECTION - B

4. *Answer the following sub-questions :*

(a) Explain deBroglies hypothesis of matter waves. Obtain an expression for deBroglie's wavelength. **10**

(b) Explain the physical significance of wave function $\Psi(\vec{r}, t)$. Obtain Schrondinger's time dependent equation. **15**

(c) Write down steady state Schrondinger's equation for motion of electron in hydrogen atom. Separate the variables r, θ, and ϕ. Hence obtain the radial Schrondinger's equation. **15**

5. *Answer the following sub-questions :*

(a) State and explain Heisenberg's uncertainty principle. With the help of suitable thought experiment, prove the uncertainty relation, $\Delta x . \Delta p_x \approx h$ where x is position and p_x is momentum. **10**

(b) If L_x, L_y and L_z are the Cartesian components of angular momentum operator. Then show that $[L_x, L_y] = i\hbar L_z$ and $[L^2, L_z] = 0$. **15**

(c) State and explain various quantum numbers used to describe motion of an electron in hydrogen atom. **15**

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Marks

SECTION - C

6. *Answer the following sub-questions :*

(a) State and explain Pauli's exclusion principle. **10**

(b) Outline the theory of rotation - vibration spectrum of a diatomic molecule. **10**

(c) Calculate mass defect, binding energy and binding energy per nucleon in the case of $_{29}Cu^{64}$, whose mass is 63.9297 a.m.u. (Given : Mass of proton = 1.007825 a.m.u., Mass of neutron m_n = 1.008665 a.m.u.). **10**

(d) Give salient features of nuclear shell model and point out its success and failures. **10**

7. *Answer the following sub-questions :*

(a) State the postulates of Bohr's theory of hydrogen atom. **10**
The wavelength of first spectral line of the Balmer Series is 6563A°. What is the wavelength of the first spectral line of Lyman series ?

(b) Explain in brief Raman effect and pure rotational Raman Spectra. **10**

(c) Write short note on 'Basic Nuclear Properties'. **10**

(d) What do you mean by Nuclear Fission and Fusion ? Explain. **10**

SECTION - D

8. *Answer the following sub-questions :*

(a) State and briefly explain Bragg's law for X-ray diffraction in crystals. **15**
Calculate the longest wavelength that can be analysed by a rock-salt of crystal spacing 2.82 A° in the 1st and 2nd order.

(b) Describe the Hall effect. Show that the Hall coefficient is independent of the applied magnetic field and is inversely proportional to the current density and electronic charge. **10**

(c) Define : **15**
(i) Rectification
(ii) Zener breakdown
(iii) Ripple factor
(iv) h - parameters
With neat diagram, explain working of Zener Shunt Regulator.

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Marks

9. *Answer the following sub-questions :*

(a) Distinguish between : **15**

(i) Metal, Semiconductor and Insulator.

(ii) Diamagnetism, Paramagnetism and Ferromagnetism.

(b) Explain working of P - N junction diode in forward and reverse bias condition. **10**

(c) Describe in brief with symbol and truth table of following logic gates : **15**

(i) AND gate

(ii) OR gate

(iii) NOT gate

(iv) NOR gate

(v) NAND gate

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