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PGIVS-062 B-21
M.Sc. IV Semester Degree Examination
PHYSICS
(Energy Physics - II)
Paper - SCT - 4.2

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer all the questions of **15** marks each and any two questions of **10** marks.

1. a. Give the classification of neutrons based on their energy.
   b. Discuss briefly the energy loss phenomenon of neutrons. **(6+9)**

(OR)

2. Discuss in detail diffusion of neutrons. Explain terms, diffusion coefficient and diffusion length. **(15)**
3. a. Define critical size of the reactor. Obtain the critical size of a bare homogeneous reactor in case of cylindrical assembly.
   b. Write a note material buckling. **(10+5)**

(OR)

4. Give an account of nuclear power reactor with a special reference to gas cooled and graphite moderated reactor. **(15)**
5. What are thermonucler reactions? Discuss the Lawson's condition for fusion reactor. **(15)**

(OR)

6. a. What is plasma? Discuss the properties of plasma.
   b. Give the construction and working of Tokomak. **(5+10)**
7. a. What is biomass? Justify why it is treated as renewable energy source.
   b. Discuss in detail construction and working of vertical axis wind mill. **(5+10)**

(OR)

8. What is bioconversion? Give an account of microbial and plant photosynthesis. **(6+9)**

9. Discuss Fermi age theory. **(10)**

10. Write a note on fast breeder reactors. **(10)**

11. Write a note on stellarator fusion reactor. **(10)**

12. Write a note on sources of geothermal energy. **(10)**

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PGIVS-057-B-21

M.Sc. IV Semester (CBCS) Degree Examination

PHYSICS

Statistical Mechanics

Paper : HCT - 4.1

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer all the questions of **15** marks each and two questions of **10** marks.

1.	a.	Explain phase space.	**(6)**
	b.	State and Prove Liouville's theorem.	**(9)**
		(OR)	
2.	a.	What is an ensemble? Explain different types of ensembles.	**(8)**
	b.	Obtain the most probable distribution function in case of grand canonical ensemble.	**(7)**
3.	a.	Obtain the rotational partition function.	**(9)**
	b.	Explain any one physical application of Maxwell - Boltzmann distribution law.	**(6)**
		(OR)	
4.	a.	Obtain Maxwell - Boltzmann distribution function of energy.	**(10)**
	b.	Write a note on electronic partition function.	**(5)**
5.	a.	Derive Bose - Einstein distribution law for a gas of integral spin particles.	**(10)**
	b.	What are bosons and fermions? List out the differences between them.	**(5)**
		(OR)	
6.	a.	Obtain the expression for condensation temperature of Bosons.	**(7)**
	b.	Explain Einstein's theory of specific heat.	**(8)**
7.	a.	Obtain the expression for fluctuations in canonical ensemble.	**(7)**
	b.	Derive the Einstein relation for mobility in case of diffusion.	**(8)**
		(OR)	

8. a. Obtain Thomson's first and second thermoelectric relations. **(8)**

   b. Write a note on entropy and information. **(7)**

9. What are thermodynamic potentials? Explain. **(10)**

10. What is partition function? Obtain vibrational partition function. **(10)**

11. Obtain the expression for spectral density of black body radiation. **(10)**

12. Set - up Onsager relations. **(10)**

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PGIVS-059B-21

M.Sc. IV Semester (CBCS) Degree Examination

PHYSICS

(Solid State Physics - II)

Paper - SCT - 4.1

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer **all** questions of **15** marks each and **two** questions of **10** marks each.

1. Obtain general transport equations for electrical and thermal currents in metals and deduce their transport coefficients. **(15)**

(OR)

2. a. What are hot electrons?

   b. Discuss high frequency electrical conductivity in semiconductors. **(3+12)**

3. a. Define static dielectric constant and give its macroscopic description.

   b. Discuss the theory of electronic polarization and optical absorption in dielectric materials. **(6+9)**

(OR)

4. a. What are ferroelectrics? Discuss their domain structure.

   b. Give a brief account of dipole theory of ferroelectrics. **(6+9)**

5. a. Distinguish between dia and paramagnetism.

   b. Discuss the Langevin's classical theory of diamagnetism and explain it's results. **(5+10)**

(OR)

6. a. Discuss the quantization of spin waves.

   b. What are magnons? Deduce Bloch $T^{3/2}$ law for thermal excitation of magnons. **(8+7)**

7. a. Explain temperature dependence of energy gap in superconductors.

   b. What is two fluid model in superconductors? Using this model, Obtain London's equations and discuss. **(5+10)**

(OR)

8. a. Explain the concept of Fermi surface in superconductors.

   b. Discuss quantization of flux in superconductors. **(6+9)**

9. What is energy relaxation time? Explain. **(10)**

10. Discuss the thermodynamics of ferroelectric transtions. **(10)**

11. Draw the dispersion curve for spin waves and explain. **(10)**

12. Explain any two applications of high temperature superconductors. **(10)**

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PGIVS-060-B-21

M.Sc. IV Semester (CBCS) Degree Examination

PHYSICS

Materials Physics - II

Paper - SCT - 4.1

(New)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer **all** questions of **15** marks each and **two** questions of **10** marks each.

1. a. Describe the atomic model of elastic behavior with reference to force - distance and potential energy - distance curves.
   b. Explain Young's modulus as a parameter in design. **(10+5)**

(OR)

2. a. Describe Griffith's energy balance criteria in brittle materials.
   b. Explain any two mechanisms of slip. **(10+5)**
3. a. Explain types of glasses and glass forming constituents.
   b. Sketch and explain structure of silicate glasses. **(8+7)**

(OR)

4. a. Distinguish between addition and condensation polymerization in polymers.
   b. Explain polymorphism with a suitable example. **(8+7)**
5. a. Give the concept of Lorentz field.
   b. Explain Dipole theory of ferroelectricity in ferroelectric materials. **(5+10)**

(OR)

6. a. Explain B-H hysteresis loop in magnetic materials.
   b. Discuss Weiss theory of ferromagnetism. **(8+7)**
7. a. Distinguish between soft and hard ferrites.
   b. Explain the technique of determination of cation distribution in ferrites. **(7+8)**

(OR)

8. a. Explain nematic, smectic and cholesteric liquid crystalline phases.

   b. Write a note on carbon nanotubes. **(8+7)**

9. Write a note on Spring - Dashpot model. **(10)**

10. Explain mechanical and thermal properties of ceramics. **(10)**

11. Discuss various possible polarizations in dielectric materials. **(10)**

12. List out the explain any four applications of ferrites. **(10)**

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PGIVS-058-B-21

M.Sc. IV Semester (CBCS) Degree Examination

PHYSICS

(Quantum Mechanics - II)

Paper - HCT - 4.2

(New)

Time : 3 Hours **Maximum Marks : 80**

Instructions :

Answer all the questions carrying **15** marks each and two questions carrying **10** marks each.

1. a. Discuss the time - dependent perturbation theory upto first order transition amplitudes.

b. What is Sudden Approximation? Explain. **(10+5)**

(OR)

2. a. Calculate second order transition amplitudes from time - dependent perturbation theory.

b. Explain briefly the interaction of an atom with the electromagnetic wave. **(10+5)**

3. a. Explain how wave functions characterize identical particles

b. Obtain the eigen values of J^2 and J_z. **(5+10)**

(OR)

4. a. Discuss the theory of the addition of two angular momentum vectors.

b. Calculate the possible angular momentum states for $j_1 = 1/2$ and $j_2 = 1/2$. **(10+5)**

5. a. Explain how symmetry and conservation laws are related.

b. Using the relativistic energy formula for a free partilce, deduce the Schrodinger's relativistic wave equation. Comment on its limitations. **(5+10)**

(OR)

6. a. Show that the Dirac's relativistic wave equation of an electron moving in a central field leads to the existence of its spin.

b. Explain the significance of the negative energy states. **(10+5)**

7. a. What is a wave field? Explain.

   b. Obtain the classical Lagrangian field equation. **(5+10)**

(OR)

8. a. Discuss the quantization of non - relativistic Schrödinger equation.

   b. Discuss the quantization of the field. **(9+6)**

9. Write a note on Fermi's Golden Rule. **(10)**

10. Explain the formulation of Pauli's exclusion principle in terms of wave functions. **(10)**

11. Obtain the equation of continuity using the Dirac's relativistic wave equation for a free particle. **(10)**

12. Obtain the following equation of motion for any quantum dynamical variable, F:$(dF/dt)=\partial F/\partial t + (1/i\hbar)[F, H]$, where H is Hamiltonian. **(10)**

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PGIVS-061-B-21

M.Sc. IV Semester (CBSC) Degree Examination

PHYSICS

(Nuclear Physics - II)

Paper - SCT - 4.2

(New)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer **all** the questions of **15** marks each and any two questions of **10** marks.

1. a. Deduce Breit - Wigner one level formula for low energy neutrons.

b. Explain the importance of partial widths. **(10+5)**

(OR)

2. a. Outline the statistical theory of nuclear reactions.

b. Derive the expression for Kapur - Pierls dispersion formula to explain the potential scattering. **(7+8)**

3. a. What are stripping and pickup reactions? Give examples.

b. Describe the first order distorted wave Born approximation to estimate inelastic nuclear reaction cross section. **(8+7)**

(OR)

4. a. Discuss the features of heavy ion reactions.

b. Discuss the compound nucleus theory of nuclear reactions. **(7+8)**

5. a. Draw the curve between pulse height and applied voltage for a gas - filled counter and discuss.

b. Discuss the principle, construction and working of a Gel(Li). **(7+8)**

(OR)

6. a. Discuss the construction and working of a Pelletron.

b. Mention the factors that influence the biological effects of radiation. **(10+5)**

7. a. Differentiate between elastic and inelastic neutron diffraction.

   b. Elucidate the coherent and incoherent Neutron scattering cross sections. Esitmate the incoherent scattering cross section per water molecule. **(6+9)**

(OR)

8. Mention various techniques of positron annihilation. Explain any one technique to extract the information of defects in materials. **(15)**

9. Write a notes on optical model of nucleus. **(10)**

10. Discuss the formation of Quasi molecule. **(10)**

11. Discuss p-n junction as detector. **(10)**

12. Write a note on elemental analysis by RBS technique. **(10)**
