Exam Code: MSc (Physics) 209003
MCom - 213203 **Paper Code: 3339**

Programme: Master of Physics/ Master of Commerce
Semester: III
Course Title: Basics of Music (Vocal)
Course Code: IDEM 3362

Time Allowed: 3 Hours **Max Marks: 80**

Note: Attempt **five questions in all , selecting at least one question from each section. Fifth question can be attempted from any section.** Each question carries **16 marks.**

Section - A

1. Write an essay on Harmonium/Key Board. 16 Marks
2. Write 5 Alankars in Shudh Swaras. 16 Marks

Section - B

3. Define Naad and explain the types of Naad. 16 Marks
4. Write a detailed note on Jaaties of Ragas. 16 Marks

Section - C

5. Explain the importance of Music? 16 Marks
6. Write an essay on Use of Multimedia in Music. 16 Marks

Section - D

7. Write down the complete description of Raag Shivranjini. 16 Marks
8. Write down the notation of Teentaal up to dugun Layakaries. 16 Marks.

Punjabi Version

ਸੈਕਸ਼ਨ - ਏ

1. ਹਾਰਮੋਨੀਅਮ/ਕੀ-ਬੋਰਡ 'ਤੇ ਇੱਕ ਲੇਖ ਲਿਖੋ। 16 ਅੰਕ
2. ਸ਼ੁੱਧ ਸਵਰਾਂ ਵਿੱਚ 5 ਅਲੰਕਾਰ ਲਿਖੋ। 16 ਅੰਕ

ਸੈਕਸ਼ਨ - ਬੀ

3. ਨਾਦ ਨੂੰ ਪਰਿਭਾਸ਼ਿਤ ਕਰੋ ਅਤੇ ਨਾਦ ਦੀਆਂ ਕਿਸਮਾਂ ਦੀ ਵਿਆਖਿਆ ਕਰੋ। 16 ਅੰਕ
4. ਰਾਗਾਂ ਦੀਆਂ ਜਾਤੀਆਂ ਬਾਰੇ ਵਿਸਤ੍ਰਿਤ ਨੋਟ ਲਿਖੋ। 16 ਅੰਕ

ਸੈਕਸ਼ਨ - ਸੀ

5. ਸੰਗੀਤ ਦੇ ਮਹੱਤਵ ਬਾਰੇ ਦੱਸੋ? 16 ਅੰਕ
6. ਸੰਗੀਤ ਵਿੱਚ ਮਲਟੀਮੀਡੀਆ ਦੀ ਵਰਤੋਂ 'ਤੇ ਇੱਕ ਲੇਖ ਲਿਖੋ। 16 ਅੰਕ

ਸੈਕਸ਼ਨ - ਡੀ

7. ਰਾਗ ਸ਼ਿਵਰੰਜਨੀ ਦਾ ਪੂਰਾ ਵੇਰਵਾ ਲਿਖੋ। 16 ਅੰਕ
8. ਤੀਨਤਾਲ ਦੀ ਨੋਟੇਸ਼ਨ ਦੁਗੁਨ ਲੈਅਕਾਰੀ ਤੱਕ ਲਿਖੋ। 16 ਅੰਕ

Exam Code: 209003 Paper Code: 3215

Programme : **Master of Science (Physics)** Sem **III**
Course Title - **QUANTUM MECHANICS-II**
Course Code - **MPHL-3391**

Time Allowed - **3 HOURS** Maximum Marks - **80**

Note:. Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries equal marks.

			Marks
	SECTION-A		
Q. 1	What do you mean by term perturbation? Provide a step-by-step derivation of the first-order perturbation correction to the energy for a non-degenerate system.		[16]
Q.2	(a)	Define the variation method and explain its use in finding approximate solutions to the Schrödinger equation.	[8]
	(b)	Calculate the transition probability per unit time for a quantum system subjected to a harmonic perturbation.	[8]
	SECTION-B		
Q. 3	Derive the second-order Born approximation and discuss how it accounts for higher-order corrections in scattering.		[16]
Q. 4	Explain the concept of partial wave analysis in scattering theory. Describe how partial wave amplitudes and phase shifts can be used to analyze scattering data.		[16]
	SECTION-C		
Q. 5	Explain the Klein-Gordon equation and its significance in relativistic quantum mechanics. Discuss the key differences between the Klein-Gordon equation and the Schrödinger equation.		[16]
Q. 6	(a)	Describe the physical interpretation of the positive and negative energy solutions of the Dirac equation.	[8]
	(b)	Discuss the origin of the spin-orbit energy and its impact on the energy levels of electrons in atoms.	[8]
	SECTION D		
Q. 7	Given a wave function for a system of two indistinguishable bosons: $\psi(x_1, x_2) = A(e^{-x_1^2} + e^{-x_2^2})$ where x_1 and x_2 are the positions of the two particles, and A is a normalization constant. Calculate the value of A that makes the wave function properly symmetrized for bosons.		[16]

Q. 8	(a)	Explain how Slater determinants are used to construct wave functions for multi-electron systems, and discuss the resulting electronic structure.	[8]
	(b)	Discuss the significance of the Pauli Exclusion Principle for fermions and its implications for the electronic structure of atoms and molecules.	[8]

Exam Code: 209003 **Paper Code: 3216**
(30)

Programme: Master of Science (Physics)
Semester-III

Course Title: Electrodynamics-II

Course Code: MPHL-3392

Time Allowed: 3 Hours **Max Marks: 80**

Note: The candidates are required to attempt five questions in all. Selecting one question from each section A,B,C, D and fifth question may be attempted from any section. Each question carries 16 marks. Use of Non-Scientific calculator is allowed.

Section A

1. a) What is the cavity resonator? Derive the TE mode field equations for rectangular cavity resonator? (12)
   b) How does the wave guide and resonant cavity differ? (2)
   c) Which type of waveguide Can support TEM mode? Give an example? (2)
2. a) Calculate the transverse field components of cylindrical waveguide in TM mode? (12)
   b) Write down boundary conditions for TM and TE mode in a cylindrical and rectangular waveguide? (4)

Section B

3. a) Start from the 4 4 second rank anti-symmetric tensor and construct the field tensor using the Lorentz boost transformation matrix. (12)

   b) Show that the four dimensional scalar product is invariant under Lorentz transformations? (4)

4. a) Derive Maxwell's equation from its compact tensor form? (12)

   b) A clock keeps the correct time. With what speed should it be moved relative to an observer so that it may appear to lose 4 minutes in 24 hours. (2)

   c) Discuss that the twin paradox is not a paradox at all? (2)

Section C

5. Derive an expression for centre fed linear antenna? (16)
6. a) Derive the Abraham-Lorentz formula? (12)

   b) Define radiation reaction force and radiation damping? (2)

   c) Write down fields due to electric dipole and quadrupole? (2)

Section D

7. Derive the Lienard Wiechart potentials for a moving point charge? (16)
8. Derive the expression for radition from an accelerated charge at low and high velocity? (16)

Exam Code: 209003 **Paper Code: 3217**
(30)

Programme: Master of Science (Physics)
Semester-III

Course Title: Condensed Matter Physics-II

Course Code: MPHL-3393

Time Allowed: 3 Hours **Max Marks: 80**

Note: The candidates are required to attempt five questions in all. Selecting one question from each section A,B,C, D and fifth question may be attempted from any section. Each question carries 16 marks. Use of Scientific calculator is allowed.

Section A

1. Explain the paramagnetism and describe the Langevin's theory of paramagnetism. 16
2. (a) Explain the concept of cooling Adiabatic demagnetization. 4
   (b) What do you mean by magnetic susceptibility. 4
   (c) Explain the origin of magnetism. 4
   (d) How diamagnetism is different from paramagnetism. 4

Section B

3. (a) Draw a B-H curve for a ferromagnetic material and identify the retentivity and the coercive field on the curve. What is the energy lost per cycle? 4

   (b) What are ferrites How they are superior to ferromagnetic materials. 4

   (c) What is mean by anisotropy energy in ferromagnetic materials. 4

   (d) Explain Bloch Wall and domain Wall energy. 4

4. Distinguish between ferromagnetic, ferromagnetic and antiferromagnetic materials with examples and discuss the uses of ferrites. 16

Section C

5. Derive the London's equation and explain the term coherence length. 16

6. Discuss DC and AC Josephson's effect. Show that the super current of super conducting pairs across the junction depends on the phase difference. 16

Section D

7. Write a short note on the following

   (a) Excitation and emission

   (b) Direct and indirect band gap

   (c) Decay Mechanism

(d) Sulfide phosphors (16)

8. (a) Why are metals transparent to high-frequency X-ray and y-ray radiation? 4

(b) Briefly explain why metals are opaque to electromagnetic radiation having photon energies within the visible region of the spectrum. 4

(c) Can a material have a positive index of refraction less than unity? Why or why not? 4

(d) Briefly describe the phenomenon of photoconductivity. 4

Exam Code: 209003 **Paper Code: 3218**
(30)

Programme: Master of Science (Physics)
Semester-III

Course Title: Nuclear Physics

Course Code: MPHL-3394

Time Allowed: 3 Hours **Max Marks: 80**

Note: Attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

Section-A

1. Explain the charge independence and spin dependence nature of nuclear forces. (16)
2. (a) Discuss the meson theory of nuclear forces. (10)
   (b) How was the mass of pi-meson estimated by Yukawa? (6)

Section-B

3. What are magic numbers? Discuss the shell model of nucleus to explain magic numbers. (16)

4. (a) Write four similarities between a liquid drop and an atomic nucleus. (4)
   (b) Derive semi-empirical mass formula using liquid drop model of nucleus. (12)

Section-C

5. What is neutrino hypothesis? Discuss Fermi theory of beta-decay in the support of neutrino hypothesis. (16)
6. (a) Discuss the Cowans and Reins experiment for the detection of antineutrino. (6)
   (b) Discuss the experiment which confirmed the parity violation in beta-decay. (10)

Section-D

7. Explain Breit Wigner one level formula for nuclear reactions. (16)
8. (a) Using suitable examples, explain various conservation laws followed in nuclear reaction. (12)
   (b) How compound nucleus reactions are different from direct reactions. (4)