F–1325

Sub. Code
7MPHE1A

M.Sc. DEGREE EXAMINATION, APRIL – 2024

First Semester

Physics

Elective : NUMERICAL METHODS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions

1. Define Rounding off errors.

2. Write a short note on method of averages.

3. Write down the iterative formula for Newton Raphson method.

4. Define the term pivotal.

5. Write the Newton forward interpolation formula.

6. Give the divided difference table.

7. What is the difference between Euler's method and improved Euler's method.

8. List out the distinguish properties of Runge-Kutta method.

9. Write down the formula for Trapezoidal rule.

10. Give the practical application of Simpson's rule.

Part B $(5 \times 5 = 25)$

Answer **all** questions choosing either (a) or (b).

11. (a) Explain the general formula for errors, observation and measurements.

Or

(b) Explain the Linear regression formula.

12. (a) Find a root of the equation $x^3 - 4x - 9 = 0$ correct to three decimal places by using the iteration method.

Or

(b) Deduce the Newton Raphson formula from a Linear equation.

13. (a) Obtain the interpolation polynomial for the given data by using Newton forward difference formula.

x	0	2	4	6
y	–3	5	21	45

Or

(b) Derive the Lagrange's Interpolation formula for unequal intervals.

14. (a) Using Euler's improved method, find the values of y when $x = 0.1$ given that $y(0) = 1$ and $y' = x^2 + y$.

Or

(b) Write down the C-program for solving ordinary differential equation using Runge-Kutta method.

15. (a) Derive the formula for Simpson's $\frac{1}{3}$ rule of integration.

Or

(b) Evaluate $\int_0^{\pi} \frac{\sin x}{x}$ in 10 equal interval using trapezoidal rule.

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Fit a straight Line to the following data.

x	1	6	11	16	20	26
y	13	16	17	23	24	31

17. Show that the iterative formula for finding the reciprocal of N is $x_{n+1} = x_n(2 - Nx_n)$ and hence find the value of $\frac{1}{31}$.

18. Given $\sin 45 = 0.7071$, $\sin 50 = 0.7660$, $\sin 55 = 0.8192$ $\sin 60 = 0.8660$, find $\sin 52$ by Newton's formula.

19. Prove that the solutions for the equation $\frac{dy}{dx} = y, y(0) = 1$ yields $y_m = \left(1 + h + h^2\right)^m$ using second order Runge Kutta method.

20. Apply trapezoidal rule to evaluate $\int_0^1 \frac{1}{1+x} dx$ to the three decimal places by Simpson's $\frac{1}{3}$ rule with height $h = 0.5, 0.25, 0.125$.

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F–1326

Sub. Code
7MPH2C1

M.Sc. DEGREE EXAMINATION, APRIL 2024

Second Semester

Physics

SOLID STATE PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** the questions.

1. Define Co-ordination number.

2. State Bragg's law.

3. How do you analyse strain?

4. Define stiffness constant.

5. Differentiate the normal and U-process.

6. State Bloch theorem.

7. Define Magnetic susceptibility.

8. What are Domains?

9. What is exchange field?

10. Differentiate between Type-I and Type-II superconductors.

Part B (5 × 5 = 25)

Answer **all** the questions choosing either (a) or (b).

11. (a) Discuss crystal structure of Nacl, Cscl in detail.

Or

(b) Write a short note on different types of point defects in solids.

12. (a) What is elastic wave in a crystal? Explain the wave in [111] direction.

Or

(b) Discuss Newton's elastic scattering.

13. (a) Explain the salient features of band theory.

Or

(b) Discuss the variation of fermi level with temperature.

14. (a) Explain Anti ferro electricity in detail.

Or

(b) Explain quantum theory paramagnetism in details.

15. (a) Explain the hysteresis phenomenon in ferromagnetic materials.

Or

(b) Explain the Meissner effect in detail.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe powder crystal method structure analysis.

17. Deduce vibrational models of a finite one dimensional diatomic lattice.

18. With a suitable diagram explain the Kronig Penny model.

19. Derive Clausius-Mossotti equation.

20. Discuss the applications of superconductors.

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F–1327

Sub. Code
7MPH2C2

M.Sc. DEGREE EXAMINATION, APRIL 2024

Second Semester

Physics

MATHEMATICAL PHYSICS — II

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Find the Laplace transform $f(t) = \sin h(at)$.

2. What is linear property of Laplace transform?

3. Write down heat conduction equation.

4. What is the difference between linear and non-linear partial differential equation?

5. Write all possible equations of transformation for a mixed tensor of rank four.

6. Define metric tensor.

7. Give the characteristics of cyclic group.

8. What do you mean by a coset of a group? Is coset a group?

9. What is gamma functions?

10. Find the value of $\int_{-\alpha}^{\alpha} e^{-x^2} H_2(x) H_3(x)\, dx$.

Part B (5 × 5 = 25)

Answer **all** questions choosing either (a) or (b).

11. (a) Using convolution theorem, evaluate $\int_0^t u^2 e^{-a(t-u)}\, du$.

Or

(b) State and prove the first and second shifting theorems of Laplace transform.

12. (a) Outline the technique of solving partial differential equation by the method of separation of variables.

Or

(b) Obtain Laplace equation for transverse vibration of a beam.

13. (a) Distinguish between a symmetric and anti-symmetric tensor.

Or

(b) Prove that kronecker delta is a mixed tensor of rank two.

14. (a) Discuss about the Homonorphism and Isomorphism.

Or

(b) Explain construction of character table of c_{2v} point group.

15. (a) Explain the orthogonal property of Hermite polynomial.

Or

(b) Solve the Laguerre's differential equation $x\,y'' + (1-x)\,y' + \lambda y = 0$, where λ is constant.

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Using Laplace transform solve the differential equation $y'' - 4y' + 8y = e^{2t}$ with $y(0) = 2$ and $y'(0) = -2$.

17. Obtain the equation of motion for a vibrating string.

18. Discuss the application of tensor analysis to the dynamics of a particle.

19. Define and deduce the proof of orthogonality theorem for the irreducible representations of a group.

20. Briefly explain the Bessel's differential equation and Bessel's function of first kind.

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F–1328

Sub. Code
7MPH2C4

M.Sc. DEGREE EXAMINATION, APRIL 2024

Second Semester

Physics

QUANTUM MECHANICS – II

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Define perturbation theory.
2. State Fermi's Golden rule.
3. Write an expression in terms of Green's Function.
4. What is partial wave analysis?
5. What is phase shift?
6. Define spontaneous emission of radiation.
7. Write down the expression for Klein Garden equation.
8. Define the following terms:
   (i) Change density
   (ii) Current density
9. Write an expression for classical Lagrangian equation.
10. Define the number operator.

Part B (5 × 5 = 25)

Answer **all** questions choosing either (a) or (b).

11. (a) Explain the transition probability of constant perturbation theory.

Or

(b) Elaborate the time dependant perturbation theory.

12. (a) Write an expression for partial wave analysis with examples.

Or

(b) Explain Born approximation with its validity.

13. (a) Derive an expression for Einstein coefficient with examples.

Or

(b) Explain the spontaneous emission of radiation from semi classical theory.

14. (a) Explain the charge and current density with examples.

Or

(b) Write down the expression for Dirac equation in electromagnetic field.

15. (a) Explain the classical Lagrangian equation with examples.

Or

(b) Write on expression for quantization of electromagnetic field energy and momentum.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss the following terms:

    (i) Collision approximation,

    (ii) Adiabatic approximation and

    (iii) Sudden approximation.

17. Derive an expression of Green's function of scattering amplitude.

18. Derive an expression for Einstein coefficient in the radiation field.

19. Discuss about Klein – Gordon equation in the electromagnetic field and give its uses.

20. Discuss about the field quantization of the Non-relativistic Schrödinger equation in terms of creation, destruction and operators with examples.

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F–1329	Sub. Code
	7MPH3C1

M.Sc. DEGREE EXAMINATION, APRIL 2024

Third Semester

Physics

ATOMIC AND MOLECULAR PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Write the various quantum number in vector atom model.
2. Define Hund's model.
3. Define zeeman effect.
4. What in the stimulation emission?
5. What do you understand by symmetric top molecules?
6. State Raman effect.
7. Define selection rule.
8. What is dissociation energy?
9. Write the principles of NMR.
10. Define 'g' factor.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) With a suitable diagram explain hyperfine spectrum.

Or

(b) State and explain Pauli's exclusion principle.

12. (a) Explain the concept of paschen–back effect of one electron system.

Or

(b) Discuss the Huckel's molecular approximation.

13. (a) Explain the details of rotational spectra diatomic molecules.

Or

(b) Differentiate characteristic and group frequencies.

14. (a) Explain quantum theory of Raman effect.

Or

(b) Discuss in details about Franck–London principle.

15. (a) Explain the classical description of NMR Spectroscopy.

Or

(b) Discuss the experimental method of single coil method of NMR.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the existence of vector atom model by stern–Gerlach experiment and also explain the fine structure of atom model.

17. Derive and explain Huckel's molecular approximation and also list out the application of benzene.

18. Discuss the Rotational spectra of polyatomic molecules.

19. Discuss Franck–Condon principle.

20. Write a brief note on chemical shift and coupling constant.

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F–1330

Sub. Code
7MPH3C2

M.Sc. DEGREE EXAMINATION, APRIL 2024

Third Semester

Physics

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Define binding energy.

2. Write a short note on elements of two body problem.

3. Define internal conversion.

4. Write a short note on semiconductor detector.

5. Give the quantity of energy released in fission process

6. Define cold fusion.

7. What are the kinds of nuclear reactions?

8. Write a short note on compound nucleus.

9. Write the concept of Antimatter.

10. Write a note on Baryon.

Part B (5 × 5 = 25)

Answer **all** questions choosing either (a) or (b).

11. (a) Elaborate the concept on spin and parity.

Or

(b) Write about neutron and proton scattering at low energies.

12. (a) Fermi theory of beta decay.

Or

(b) Explain the principle and working of ionization chamber with suitable diagram.

13. (a) Describe the principle and working of synchrocyclotron.

Or

(b) Explain the concept of controlled thermonuclear reaction.

14. (a) Discuss the conservation laws in nuclear reactions.

Or

(b) Compare the characteristics of direct and pick up reactions.

15. (a) Classify the interaction of elementary particles according to their strength.

Or

(b) Explain CPT Theorem.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Derive the Weizacker's semi-empirical mass formula.

17. Outline Gamow's theory of alpha decay and explain how it leads to Geiger-Nuttal Law.

18. Explain nuclear fission on the basis of Bohr-Wheelers theory.

19. Derive the Breit-Wigner one level formula for scattering in nuclear reaction.

20. Outline the theory of Quark model.

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F–1331	Sub. Code
	7MPH3C3

M.Sc. DEGREE EXAMINATION, APRIL 2024

Third Semester

Physics

ADVANCED ELECTRONICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Why SCR cannot be used as a bidirectional switch?

2. Write the working principle of LED.

3. What is a antilog amplifier?

4. What are active and passive filters of op–amp?

5. Differentiate between synchronous counters and ripple counter.

6. What are the applications of SRAM?

7. List out the advantages of astable multivibrator.

8. How many output levels are possible in a two–bit D/A converter?

9. What is a tunnelling?

10. Define modulation.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain V–I characteristics of p–n junction diode.

Or

(b) Describe the working of SCR.

12. (a) What are the characteristics of ideal op–amp. Write about bandwidth and slew rate of op–amp.

Or

(b) Discuss the operation of first order low pass filter. Also sketch its frequency response.

13. (a) Explain the construction and working of clocked RS flip flop.

Or

(b) What is CCD? Illustrate the principle and working of charge coupled device with diagram.

14. (a) Find out the frequency, time period and duty cycle of an astable multivibrator using 555 timer with resistors R_A = 2.2 K, R_B = 100 K, capacitor C = 1000 pF.

Or

(b) Explain the working of R–2R Ladder type of D/A converter.

15. (a) Sketch two cavity Klystrons and explain.

Or

(b) List out the method of generation of FM. Discuss in detail direct method of FM generation.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the construction and VI characteristics of the silicon controlled rectifier as a function of gate current.

17. Illustrate the operation of voltage to current and current to voltage converter circuit.

18. Explain the action of JK flip flop with neat diagram. Also explain what is meant by race around condition in connection with JK flip flop.

19. Explain the function of successive approximation method in A/D converter.

20. Describe the construction and working of tunnel diode. Draw the V–I characteristics of it and explain.

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F–1332	Sub. Code
	7MPHE3B

M.Sc. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Physics

Elective – ANALYTICAL INSTRUMENTATION

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Mention the types of detectors used in UV visible spectro photometer.
2. What is the working principle of absorption instrument?
3. What are the types of detectors used in IR spectroscopy?
4. List out the sources of atomic emission spectrometer.
5. What are the differences between XRD and Raman spectroscopy?
6. What is Raman Effect in X-ray?
7. What is the working principle of SEM?
8. Define Lande's splitting factor.
9. What are the applications of Atomic Absorption Spectroscopy?
10. Mention the applications of flame spectrometer.

Part B (5 × 5 = 25)

Answer **all** questions choosing either (a) or (b).

11. (a) Describe the requirement of sensitive detectors used for spectrophotometer.

Or

(b) Explain the principle and working of photomultiplier tube.

12. (a) Explain the working principle of photo electric detector.

Or

(b) Write a note on radiation sources.

13. (a) Explain with a neat diagram X-ray fluorescence spectrophotometer.

Or

(b) How to prepare a solid sample for Raman spectroscopy studies.

14. (a) Explain the principle of ESR spectrometer.

Or

(b) What are the merits and demerits of SEM?

15. (a) Explain the Principle of Flame emission spectroscopy.

Or

(b) What are the applications of Atomic fluorescence spectrometry?

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. With a neat diagram, explain the instrumentation system of visible spectro photometer.

17. With a block diagram, explain the operation of an IR spectrophotometer.

18. Explain the functions of various components in LASER Raman spectrometer.

19. Explain in details the Electron spectroscopy for chemical analysis.

20. Explain the instrumentation and its applications of Atomic Fluorescence spectroscopy.

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F–1333

Sub. Code
7MPHE4B

M.Sc. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Physics

Elective – COMMUNICATION ELECTRONICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. What are the difference between VHF and UHF antenna?
2. Define noise temperature in communication.
3. What are the advantages of delta modulation?
4. What is frequency division multiplexing?
5. Define pulsed RADAR.
6. What is a TRAPATT?
7. Mention the advantages of graded index fibre.
8. What are the different types of optical slicing?
9. What is the use of Marisat satellite?
10. Why is the satellite link probably the most basic in microwave communications?

Part B (5 × 5 = 25)

Answer **all** questions choosing either (a) or (b).

11. (a) Explain the theory of amplitude modulation.

Or

(b) Explain the working of microwave antenna.

12. (a) Explain pulse position modulation technique.

Or

(b) Write note on phase shift keying.

13. (a) Explain the construction and working of magnetron.

Or

(b) Derive Radar Range equation.

14. (a) Discuss the propagation of light in a graded index fibre.

Or

(b) A step index fibre has a normalised frequency V = 26.6 at 1300 nm wavelength. If the core radius is 25 μm, find the numerical aperture.

15. (a) Explain MARISAT satellites.

Or

(b) Write note on cellular standards.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe SSB–SC–AM. Explain the phase shift method of generating it. Also explain the frequency spectrum.

17. Explain in details about PCM.

18. Explain the reflex klystron operation with a neat schematic diagram.

19. What do you understand by optical detector? Discuss its various type of optical detector and parameters of photo detector.

20. List the features of GSM. Explain its architecture.

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F–1334

Sub. Code
7MPHE5A

M.Sc. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Physics

Elective : ENERGY AND ENVIRONMENTAL PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Write about transport of energy.
2. What is composition of air?
3. Define Pyroheliometer.
4. List out the advantages of focusing collector.
5. What are the types of digesters?
6. How is bio energy produced?
7. What are the classifications of biogas plants?
8. Give some of the fuels that are used in fuel cells.
9. Define plumes.
10. What is heat island effect?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) State and explain Raynold's transport theorem.

Or

(b) List out the major causes of green house effect.

12. (a) Derive the energy balance equation to describe the working of solar collector.

Or

(b) Elaborate the solar radiation on tilted surface.

13. (a) Point out the factors that affect bio digestion. Explain any two of them.

Or

(b) Tabulate the advantages and disadvantages dome and drum type biogas plant.

14. (a) Write the applications of fuel cells.

Or

(b) How is hydrogen used for electricity generation?

15. (a) What are the factors that governs air and water pollution?

Or

(b) Compare land and sea breeze.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss the transport of matter, energy and momentum in nature.

17. Explain in detail about flat plate and concentrating type solar collector.

18. Classify and explain the types of biomass conversion technologies.

19. Enumerate the different types of fuel cells.

20. Discuss the purification and control devices of water and air pollution.

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