F–8471	Sub. Code
	7MPH1C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

First Semester

Physics

MATHEMATICAL PHYSICS – I

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Compute the line integral $\int xdy - ydx$ over the straight line from $(0,0)$ to $(1,1)$.

2. Whether the vectors $(1,0,0)$, $(1,1,0)$ and $(1,1,1)$ are linearly independent or dependent?

3. Obtain the general solution of the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.

4. Show that the vector $(1,1,2)$ is an eigenvector of the matrix $A = \begin{pmatrix} 3 & 1 & -1 \\ 2 & 2 & -1 \\ 2 & 2 & 0 \end{pmatrix}$.

5. Find the residue of the function $\frac{z^3}{(z-2)(z-3)}$ at its poles.

6. Point out the singular point and discuss the nature of it for the function $f(z) = \operatorname{cosec} z$.

7. Mention the role of Fourier series in mathematical physics.

8. State any two conditions under which a function can be expanded in the form of a Fourier series.

9. Find the finite Fourier cosine transform of x.

10. State the linearity theorem of Fourier transform.

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

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

11. (a) Using Green's theorem evaluate $\int_C (x^2 + 2xy)\,dx + (y^2 + x^3 y)\,dy$, where C is a square with the vertices $P(0,0), Q(1,0), R(1,1)$ and $S(0,1)$.

Or

(b) Use the Gram-Schmidt orthonormalization process to determine an orthonormal basis in $\mathbb{R}^3$ for the given set of independent vectors $x_1 = [1\,0\,1]^T$, $x_2 = [-1\,1\,0]^T$ and $x_3 = [-3\,2\,0]^T$.

12. (a) Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$.

Or

(b) Determine the solution of the differential equation $x\frac{dy}{dx} + y = x^4$, with the boundary condition that $y = 1$ at $x = 1$.

13. (a) Find the conjugate harmonic function $v(x, y)$ of the function $u(x, y) = x(-3y^2 + x^2)$.

Or

(b) Obtain the first few terms of the Laurent series expansion of $f(z) = \dfrac{5z - 3}{z(z^2 + z - 2)}$ which would converge with annular region $1 < |z| < 2$.

14. (a) Obtain Fourier series of the function

$$f(x) = \begin{cases} x & -\pi < x < 0, \\ -x & 0 < x < \pi. \end{cases}$$

Or

(b) A periodic function of period 4 is defined as $f(x) = |x|$, $-2 < x < 2$. Find its Fourier series expansion.

15. (a) Using Parseval's identity, prove $\int_0^\infty \left(\dfrac{\sin t}{t}\right)^2 dt = \dfrac{\pi}{2}$.

Or

(b) State and Prove convolution theorem on Fourier transform.

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

Answer any **three** questions.

16. State and prove Gauss Divergence theorem.

17. Find A^4 with the help of Cayley-Hamilton theorem if $A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$.

18. Using contour integration evaluate the real integral $\int_0^\infty \frac{dx}{(1+x^2)^3}$.

19. Find the Fourier half-range cosine series of the function

$$f(x) = \begin{cases} 2t & 0 < t < 1, \\ 2(2-t) & 1 < t < 2 \end{cases}.$$

20. Find the Fourier cosine transform of $\frac{1}{1+x^2}$ and hence find Fourier sine transform of $\frac{x}{1+x^2}$.

F–8472	Sub. Code
	7MPHE1A

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

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. What are errors in numerical methods?

2. What is linear correlations?

3. What is the formula of Regula-falsi method?

4. State the order of convergence and convergence condition for Newton-Raphson method.

5. Give the Gregory Newton forward interpolation formula.

6. State Newton's divided difference formula.

7. Write down the Euler's modified formula.

8. State the third order Runge – kutta algorithm.

9. When to use Newton's forward interpolation and when to use Newton's backward interpolation.

10. When do you apply Simpson 1/3 rule and what is the order of the error in Simpson's 1/3 rule.

Part B (5 × 5 = 25)

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

11. (a) Find the value of $s = \frac{a^2\sqrt{b}}{c^3}$ where $a = 6.54 \pm 0.01$, $b = 48.64$ and $c = 13.5 \pm 0.03$. Also, find the relative error in the result.

Or

(b) Find the best values of a_0 and a_1, if the straight line $y = a_0 + a_1 x$ is fitted to the data (x_i, y_i): [1,0.6],[2,2.4], [3,3.5],[4,4.8], [5, 5.7]. Also find the correlation co-efficient.

12. (a) Determine the real root of the equation $x^3 - 2x - 5 = 0$ and correct to 3 decimal places using the method of false position.

Or

(b) Solve the system by Gauss-Jordan method.

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16$

13. (a) Using Lagrange's interpolation formula, find the form of the function $y(x)$ from the following table.

x	y
0	–12
1	0
3	12
4	24

Or

(b) Describe the Gauss forward formula.

14. (a) Given $\frac{dy}{dx} = y - x$, where $y(0) = 2$, find $y(0.1)$ and $y(0.2)$ correct to four decimal places by Runge Kutta 2nd order method.

Or

(b) Write a program for Euler's method for solving first order difference equations.

15. (a) Compute derivative using Newton's forward and backward difference formulae.

Or

(b) Evaluate $I = \int_0^1 \frac{1}{1+x} dx$ by Trapezoidal rule with $h = 0.5$ and 0.25 respectively and correct to three decimal places.

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

Answer any **three** questions.

16. Fit a function of the form $y = A_1 e^{\lambda_1 x} + A_2 e^{\lambda_2 x}$ to the data defined by (x, y)

(1,1.54), (1.1, 1.67), (1.2, 1.81), (1.3, 1.97), (1.4, 2.15), (1.5, 2.35), (1.6, 2.58), (1.7, 2.83), (1.8, 3.11).

17. Write a C program for finding roots of Newton Raphson method.

18. By means of Newton's divided difference formula, find the value of $f(8)$ given.

x	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

19. Apply the fourth order Runge kutta method to find an approximate value of y when 0.2 for x, given that $y' = x + y, y(0) = 1, h = 0.1$.

20. Dividing the range into 10 equal parts, find the approximate value of $\int_0^{\pi} \sin x \, dx$ by

(a) Trapezoidal rule

(b) Simpson's rule

F–8473

Sub. Code
7MPH2C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

Second Semester

Physics

SOLID STATE PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is Bravais lattice?

2. State Bragg's law.

3. What is phonon momentum?

4. Define Umklapp processes.

5. Define Matthiessen's rule.

6. How are Brillouin zones responsible for energy in a metal?

7. What is local electric field in an atom?

8. Define dielectric loss.

9. What is Curie-Weiss law? Mention its importance.

10. Mention the applications of cryoelectronics.

Part B (5 × 5 = 25)

Answer **all** the questions.

11. (a) Explain the crystal structure of diamond and zinc blend structure.

Or

(b) Describe with suitable diagrams of edge dislocation and screw dislocation in crystal lattice.

12. (a) What is normal and Umklapp processes? Explain the elastic wave surfaces for (111) plane of cubic crystal.

Or

(b) Describe the theory of inelastic scattering of neutrons by phonons.

13. (a) Show that the heat capacity of the electron gas is equal to $0.015R_u$.

Or

(b) Define Hall effect. Explain and deduce the expression of Hall coefficient and mobility of charge carrier.

14. (a) Brief on antiferro electricity.

Or

(b) Explain the paramagnetic susceptibility of conduction electron.

15. (a) Describe the domain theory of ferromagnetism.

Or

(b) Define BCS theory of super conductivity.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the reciprocal lattice of BCC and FCC structure.

17. (a) Explain the theory of vibration of monoatomic lattice.

    (b) Explain quantization of lattice vibrations.

18. Describe the theory of Krong-Penny model for the motion of electron in a periodic potential.

19. Applying internal molecular theory, deduce the expression of quantum theory of dia magnetism. Hence find the susceptibility.

20. What is Josephson's effect? Explain the theory of AC Josephson effect and show that the super current $J = J_0 \sin\left[\delta(0) - \frac{2eVt}{h}\right]$.

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F–8474

Sub. Code
7MPH2C2

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

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. State and explain any two properties of inverse Laplace transform.

2. Evaluate the integral $\int_0^\infty t\ e^{-st} \sin t\ dt$.

3. Write Laplace's equation in Cartesian and spherical polar coordinates.

4. Obtain the differential equation of a vibrating string.

5. Explain Einstein's summation convention with example.

6. What is metric tensor?

7. What do you mean by permutation group?

8. What are various symmetry elements? Explain.

9. Show that $\sqrt{\frac{1}{2}} = \sqrt{\pi}$.

10. Evaluate $J_{-1/2}(x)$.

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

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

11. (a) Derive the Laplace transform of derivative function.

Or

(b) Find the inverse Laplace transform of

$$f(s) = \frac{s-1}{(s+3)(s^2+3s+2)}.$$

12. (a) Discuss the general solution of Laplace's equation in cylindrical coordinates.

Or

(b) Write short note on Longitudinal vibration of a beam.

13. (a) If $\alpha_{\alpha\beta}\, x^{\alpha} x^{\beta} = 0$ for all values of the variables $x^1, x^2, \ldots x^n$ then show that $\alpha_{\mu v} + \alpha_{v\mu} = 0$.

Or

(b) Discuss the application of tensor analysis to the dynamics of a particle.

14. (a) Prove that the group of order four may or may not be cyclic group.

Or

(b) Write short note on character of representation.

15. (a) Solve the differential equation $y'' + (ax+b)_y^m = 0$ in terms of Bessel's functions.

Or

(b) Prove the orthogonality relation

$$\int_{-1}^{+1} P_n(x)\, P_m(x) dx = 0 \text{ if } m \neq n .$$

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

Answer any **three** questions.

16. Using Laplace transform, solve the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-x}\sin x$

where $g(0) = 0$ and $y'(0) = 1$.

17. Apply the method of separation of variables to solve the Laplace's equation $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ subject to boundary conditions $\left.\begin{matrix} v=0 \\ x=0 \end{matrix}\right\}, \left.\begin{matrix} v=0 \\ x=a \end{matrix}\right\}, \left.\begin{matrix} v=f(x) \\ y=0 \end{matrix}\right\}, for \begin{matrix} 0<x\le a \\ 0<y\le\infty \end{matrix}$.

18. Determine Metric tensor in spherical Coordinates.

19. Derive the irreducible representation for C_{2v} point group and construct its character table.

20. Obtain the series solution of Hemite differential equation $\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2ny = 0$ and find its polynomial solution, n being a positive interger.

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F–8475	Sub. Code
	7MPH2C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

Second Semester

Physics

ELECTROMAGNETIC THEORY

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. State coulomb's law. Give its limitations.

2. The electric field $\vec{E}$ is zero at a point. Is the electric potential V necessity zero at the point? Comment.

3. Define magnetic vector potential.

4. What is magnetic susceptibility? What are the values it has for diamagnetic and paramagnetic substances?

5. Write integral and differential form of Faradays law.

6. What are Gauge transformations?

7. What is Ionosphere?

8. Define wave guides.

9. What is anomalous dispersion?

10. Why does the sky appear blue?

Part B (5 × 5 = 25)

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

11. (a) Explain the classical image problem with an example.

Or

(b) Derive Poisson's and laplace equations.

12. (a) Compare electro statics and magneto station.

Or

(b) Discuss Ampere's law in magnetised material.

13. (a) State and explain faraday's law of induction.

Or

(b) Explain Dirac's quantization condition.

14. (a) Derive equation of telegraphy.

Or

(b) Give a note on transmission line.

15. (a) Explain the concept of retarded potential.

Or

(b) What do you mean by dispersion? Discuss it is the case of gaseous medium.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe electrodynamics of charged particle in an electric field.

17. State Ampere's law. Apply it to find the magnetic field due to solenoid.

18. State and prove Poynting theorem.

19. Derive Fresuel's equations for reflection and refraction of electromagnetic at the interface of istropic linear media.

20. Derive the Thomson Scattering formula for the scattering of a plane polarized electromagnetic have by a free electron.

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F–8476	Sub. Code
	7MPH2C4

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

Second Semester

Physics

QUANTUM MECHANICS II

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. State Fermi-Golden rule.

2. What do you mean by sudden approximation?

3. Define scattering cross-section.

4. Write down the validity of Born approximation.

5. What is spontaneous emission?

6. State emission rate.

7. Write Klein-Gordan equation in electromagnetic field.

8. Show that the Dirac's matrices are even dimensional.

9. Write the classical field equation in Hamiltonian form.

10. What is second quantization?

Part B (5 × 5 = 25)

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

11. (a) Explain the theory of time dependent Perturbation.

Or

(b) Give time-dependent perturbation theory for a constant perturbation acting for a short interval of time.

12. (a) Derive scattering amplitude in terms of Green's function.

Or

(b) Explain born approximation for scattering theory.

13. (a) Discuss the Einsteincs coefficients of spontaneous and induced emission of radiation.

Or

(b) List out the applications of Density matrix.

14. (a) Explain how Klein-Gordan equation leads to positive and negative probability density values.

Or

(b) Explain the physical interpretation of Dirac's α matrix.

15. (a) State and explain the classical field equation in Hamiltonian form.

Or

(b) What are creation, annihilation and number operators? Why they are called so?

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Using time dependent perturbation theory, derive an expression for the rate of transition to the continuum.

17. Discuss scattering amplitude from on Yukawa potential and columb potential.

18. Explain the radiation field as an assembly of oscillators.

19. Derive Dirac Relativistic equation for a force partick.

20. Derive field quantisation of the schrodinger equation.

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F–8477	Sub. Code
	7MPH3C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Third Semester

Physics

ATOMIC AND MOLECULAR PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** the questions.

1. Give the conclusion of Stern-Gerlach experiment.

2. State Hund's rule.

3. What is Born- Oppenheimer approximation?

4. How population inversion is achieved in a lasing medium?

5. List the essential components of a microwave spectrometer.

6. Why water can't be used as a solvent for IR spectroscopy?

7. Write the general selection rule for a molecule to be Raman active.

8. Differentiate HOMO and LUMO orbits.

9. Define chemical shit.

10. What is meant by g-factor?

Part B (5 × 5 = 25)

Answer **all** the questions.

11. (a) Explain LS and JJ coupling schemes. Which scheme holds for light atoms?

Or

(b) Give brief account on spectrum of alkali atoms.

12. (a) Write a note on Paschen – Back effect.

Or

(b) What is meant by Huckle's molecular approximation? How it explains the bond structure of benzene.

13. (a) Enumerate the features of spectra of a polyatomic molecule.

Or

(b) Discuss the theory of IR spectrum of a symmetric top molecule.

14. (a) Explain the rotational Raman shifts of a diatomic molecule.

Or

(b) State and explain Franck-Condon principle.

15. (a) Explain any one experimental technique used to study NMR.

Or

(b) Describe the working of ESR spectrometer.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the following

    (a) Spectrum of hydrogen atom. (6)

    (b) Pauli's exclusion principle. (4)

17. Define the terms spontaneous and stimulated emission and hence obtain Einstein's coefficients A and B.

18. Discuss the theory of diatomic vibrating rotator.

19. What is Raman effect? Elaborate the quantum theory of Roman effect.

20. Give a detailed account on hyperfine structure in ESR spectra.

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F–8478

Sub. Code
7MPH3C2

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Third Semester

Physics

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What are magic numbers?

2. Is nuclear force is a central force?

3. Define internal conversion with an example.

4. How does a particle detector work?

5. Write the four-factor formula.

6. Distinguish between nuclear fusion and cold Fusion.

7. How do you find the cross section of nuclear reaction?

8. Give the significance of partial wave analysis.

9. When a particle is said to be elementary?

10. What are hyperons?

Part B (5 × 5 = 25)

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

11. (a) What is meant by binding energy? Explain it using semi-empirical mass formula.

Or

(b) Discuss the theory of optical model of a nucleus.

12. (a) Write a note on non conservation of parity in beta decay.

Or

(b) Describe the construction and working of ionization chamber.

13. (a) Give an account on working of betatron.

Or

(b) Elucidate the mechanism of thermonuclear reactions with suitable examples.

14. (a) Deduce an expression for Q-value of a nuclear reaction. Analyze its significance.

Or

(b) Explain Stripping and Pick-up reactions with example.

15. (a) Briefly explain the classification of elementary particles.

Or

(b) Explain SU(2) symmetry.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain low energy n-p scattering. Deduce the expression for n-p interaction cross section.

17. Elaborate the construction and working of scintillation counter.

18. Explain Bohr Wheelers theory of nuclear fission.

19. Deduce Briet-Wigner dispersion formula.

20. Explain the following

    (a) Types of fundamental interaction. (5)

    (u) Quark theory. (5)

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F–8479

Sub. Code
7MPH3C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Third Semester

Physics

ADVANCED ELECTRONICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Differentiate LASER diode and LED.

2. Write any two applications of UJT.

3. What is instrumentation amplifier?

4. What is the function of Active filters in an electric circuit?

5. How does work Transistor – Transistor logic?

6. What is EPROM?

7. Give the importants of sample and hold circuits.

8. Why we use Op-Amp in output stage of DAC.

9. What is pulse-code modulation?

10. What is the special property of tunnel diode compared with normal diode?

Part B (5 × 5 = 25)

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

11. (a) Describe the mechanism of emission of light in light emitting diode.

Or

(b) Explain the action of JFET.

12. (a) Explain virtual ground concept and also inventing amplifier.

Or

(b) With neat diagram explain the action of antilog amplifier.

13. (a) Explain working of JK flipflop with suitable logic circuit.

Or

(b) Write note on static and dynamic RAMs.

14. (a) Explain wave from generation in phase-shift oscillator.

Or

(b) With suitable diagram describe successive approximation analog to digital converter.

15. (a) Describe working of Grid modulated class C amplifiers.

Or

(b) Discuss the characteristics of Tunnel and Gunn diodes.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe structure and V-I characteristics of Depletion MOSFET.

17. With suitable circuit explain an Op-Amp as voltage follower, investing and non-inventing amplifier.

18. Explain operation of MOD-6 and MOD-10 counter,

19. What is multivibrator? Explain working of Bistable multivibrator with neat diagram.

20. Explain techniques of generation of frequency modulated waves.

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F–8480

Sub. Code
7MPHE2A

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Third Semester

Physics

Elective – MICROPROCESSOR AND MICROCONTROLLERS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Why is the data bus bidirectional?

2. How many memory locations can be addressed by a microprocessor with 13 address lines?

3. What is interrupt driven data transfer?

4. What are the functions performed by 8279?

5. In the program status word of 8051, the bits RS0 and RS1 are 1 and 0, then which register bank is selected for operation?

6. Name the five interrupt sources of 8051.

7. Find the contents of register A after execution of the following instructions

   CLR A

   ORL A, #66H

   CPL A

8. Which registers are used for multiplication and division operations in 8051 microcontroller?

9. What is the function of the End of Conversion (EOC) pulse in ADC?

10. If a stepper mot takes 90 steps to make one complete revolution, what is the step angle for this motor?

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

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

11. (a) Write a program to add two hex numbers 7AH and 46H and to store the sum at memory location 2020H and the flag status at location 2021H.

Or

(b) Explain the requirement of a program counter, stack pointer and status flags in the 8085 microprocessor.

12. (a) Discuss the various priority modes of programmable interrupt controller 8259A.

Or

(b) Write a note on DMA data transfer scheme.

13. (a) Draw and explain the memory map for the 128 byte internal RAM of 8051 microcontroller.

Or

(b) Explain the I/O ports of 8051 microcontroller.

14. (a) Explain the following instructions.

(i) XCHD A, @R1

(ii) MOVC A,@A+DPTR

(iii) MOV A, 50H

(iv) MOV R7, #50H

(v) MOV 50H, #50H

Or

(b) Write a program to divide two 8-bit numbers which are stored in RAM location 40H and 41H. The result is to be stored in RAM location 50H.

15. (a) Draw and explain interfacing of DAC 0804 with 8051 microcontroller.

Or

(b) Design a traffic light controller system using 8051 microcontroller.

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

Answer any **three** questions.

16. Following set of instructions are executed in microprocessor 8085 to set up a delay using register.

	T-States
LXI B, 2384H	10
LOOP: DCXB	6
MOV A, C	4
ORA B	4
JNZ LOOP	10/7
RET	10

Calculate total time delay of all instructions using 2 MHz clock frequency of the system.

17. Draw the internal block diagram of 8255 programmable peripheral interface and explain its operation.

18. With the help of neat diagram, explain how to interface external memory with 8051.

19. Name the different addressing modes supported by 8051 instruction set and explain each one with the help of suitable examples.

20. Explain the 8051 microcontroller based temperature measurement system.

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F–8481

Sub. Code
7MPHE2B

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Third Semester

Physics

Elective – MODERN OPTICS AND LASER PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** the questions.

1. What is linear polarization?

2. What is total internal reflection?

3. Find the formula to determine the thickness of a thin transparent sheet from Michelson interferometer.

4. What is coherent time and coherent length?

5. What is principle behind Fresnel's interferometer?

6. Mention the uses of interferometry.

7. What is nonlinear optics? Mention some non linear materials.

8. What is parametric amplifier?

9. How does pumping process important in laser action? Mention its different types.

10. What is stimulated and spontaneous emission?

Part B (5 × 5 = 25)

Answer **all** the questions.

11. (a) Define and deduce Brewster's angle.

Or

(b) Explain the theory of reflection and refraction at a plane boundary.

12. (a) Discuss the construction and working of Fabry – Perot interferometer.

Or

(b) Explain the phenomenon behind the interference with multi beam theory.

13. (a) Describe the Kirchoff formulation of diffraction by a plane screen.

Or

(b) Explain the principle, construction and working of Gabor hologram.

14. (a) Discuss the theory of laser Raman spectroscopy.

Or

(b) Describe the observation of non linear optical process from Franken's experiment.

15. (a) Explain the applications of laser in medicine and defense.

Or

(b) Describe the construction and working of CO_2 laser with its energy level diagram.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Explain how do you estimate the electrical constant and speed of light.

    (b) What is Doppler effect? Mention its importance.

17. Describe the construction and working of Michelson interferometer. Also obtain the theory of partial coherence.

18. (a) Give a brief explanation on wave front reconstruction.

    (b) Mention the applications of hologram.

19. Explain the theory of stimulated Raman scattering and self focusing.

20. Describe the working of He–Ne laser. Draw its energy level diagram and explain it.

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F–8483

Sub. Code
7MPHE3B

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

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 features of UV-V is spectroscopy.

2. What are called monochromotors?

3. Give the example for spectroscopic sources.

4. State the IR region.

5. Expand : NMR.

6. What do you mean by SEM?

7. Write the role of ESCA.

8. What is X-ray?

9. Mention the significance of FES.

10. What is AFS?

Part B (5 × 5 = 25)

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

11. (a) Elucidate the ultraviolet absorption spectrophotometry.

Or

(b) Outline the absorption photometry.

12. (a) Write a short note on photographic detection.

Or

(b) Explain the instrumentation of IR.

13. (a) Describe the instrumentation of X-ray.

Or

(b) Elucidate the sample handling.

14. (a) Enumerate the basic principles of ESR.

Or

(b) Explain : ESCA.

15. (a) Discuss the instrumentation of FES.

Or

(b) Compare FES and AAS.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain : Absorption photometry.

17. Describe the working principle of FT – interferometer.

18. Explain : SEM.

19. Discuss the Laser Raman spectrometer with neat diagram.

20. Explain : AAS.

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F–8485

Sub. Code
7MPHE4B

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Fourth Semester

Physics

Elective — COMMUNICATION ELECTRONICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define Noise Temperature.

2. What is meant by radiation pattern?

3. What is pulse position modulation?

4. What are the advantages of QPSK?

5. Define Transit time in Reflex klystron.

6. State the necessary condition for an IMPATT to produce oscillations.

7. Name the three different mechanisms caused by absorption.

8. Define : signal Attenuation of fiber loss.

9. List out the frequency bands used for satellite services.

10. What do you meant by hand off?

Part B (5 × 5 = 25)

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

11. (a) Define amplitude modulation and modulation index. Use a sketch of a sinusoidally modulated AM waveform to help explain the definition.

Or

(b) Write a note on loop ferrite antenna.

12. (a) Draw and explain PAM generation system.

Or

(b) Explain delta modulation and demodulation technique.

13. (a) Derive the basic radar range equation.

Or

(b) What is an MTI Radar and how does it operate.

14. (a) Describe the various types of fiber connectors and couplers.

Or

(b) Distinguish step index from graded index fibers.

15. (a) Discuss the effect of orbital inclination.

Or

(b) What are the advantages of digital cellular system over analog cellular system?

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Derive the expression for noise calculation.

17. Describe in detail the PCM technique with focus on its sampling rate, and signal to quantization noise ratio.

18. With neat circuit diagrams and relevant equations, explain the velocity modulation process and bunching in a klystron amplifier?

19. Describe various fiber splicing techniques with their diagrams.

20. Explain the GSM architecture with a neat sketch.

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F–8486

Sub. Code
7MPHE5A

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

Fourth Semester

Physics

Elective — ENERGY AND ENVIRONMENTAL PHYSICS

(CBCS – 2017 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. How does atmospheric temperature vary with height?

2. What is the composition of air?

3. Define solar constant.

4. What is tilt factor?

5. What is meant by fermentation?

6. How biogas is produced?

7. How hydrogen is used as a raw material?

8. Name the five issues when hydrogen is used as an energy source.

9. Name four water pollutants.

10. When sea breeze will occur?

Part B (5 × 5 = 25)

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

11. (a) How does pressure and density vary with height?

Or

(b) Brief Indian monsoon.

12. (a) Determine the average value of solar radiation on a horizontal surface for June 22 (declination $\delta = +23.5°$) at the latitude of 10°N, if a = 0.30 and b = 0.51 and $\bar{n}/N = 0.55$.

Or

(b) Obtain the energy balance equation of a flat plate collector.

13. (a) Brief anaerobic digestion.

Or

(b) List the advantages of biogas generation with floating drum plant.

14. (a) How hydrogen is used in vehicular transport?

Or

(b) What are Hydride batteries? Explain.

15. (a) Explain the quality standards of water.

Or

(b) Give an account on waste disposal.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Explain Green house effect.

    (b) Explain energy and momentum equation.

17. Write a note on solar radiation on tilted surfaces.

18. With a neat diagram explain the working of a KVIC digester.

19. Give an account on fuel cells along with their types and applications.

20. Write a note on purification and control devices of water pollution.

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