D–1598

Sub. Code
34511

DISTANCE EDUCATION

M.Sc (Physics) DEGREE EXAMINATION, MAY 2023.

First Semester

CLASSICAL MECHANICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL the questions.

1. Define virtual work.
2. What is cyclic coordinates?
3. State Newton's law of motion.
4. Define phase-space.
5. List out the properties of poisson's bracket.
6. What is length contraction?
7. State Moment of Inertia.
8. What is principal moments?
9. Define small oscillations.
10. What is stable equilibrium?

PART B — ($5 \times 5 = 25$ marks)

Answer ALL the questions, choosing either (a) or (b).

11. (a) Derive the Lagrange's equation for simple system.

Or

(b) Classify the dynamical system. Explain.

12. (a) Discuss the theory on calculas of variation.

Or

(b) Derive time – independent Hamilton – Jacobi equation.

13. (a) Describe the theory on compound pendulum.

Or

(b) Drive Lorentz transformation equation.

14. (a) What is time dilation? Explain.

Or

(b) Deduce the expression for addition of velocities.

15. (a) Discuss the theory on one – dimensional oscillator using small oscillation.

Or

(b) Write the secular equation and eigen value equation for small oscillation.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Define D' alembert's Principle. Deduce the Lagrangian equation for general system.

17. Derive Hamilton's canonical equation.

18. State and prove Liouville's theorem.

19. Derive the kinetic energy of a rigid body rotating about a fixed point.

20. Discuss the theory on vibration of a linear triatomic molecule.

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D–1599

Sub. Code
34512

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

First Semester

MATHEMATICAL PHYSICS – I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find $\nabla.\vec{r}$.

2. Define divergence of a vector function.

3. What is line integral?

4. Define Hermitian matrix with example.

5. Write any two properties of matrix addition.

6. Find the rank of matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.

7. Prove the symmetry property of beta function.

8. Find $\sqrt{(5)}$.

9. Find Fourier sine transform of $\frac{\perp}{x}$.

10. Mention the property of Laplace transform.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) If $A = 4\vec{i} - 5\vec{j} + 3\vec{k}$; $B = 2\vec{i} - 10\vec{j} - 7\vec{k}$; $C = 5\vec{i} + 7\vec{j} - 4\vec{k}$, deduce the values of (i) $(A \times B).C$ and (ii) $A \times (B \times C)$.

Or

(b) Derive an expression for Poisson's equation.

12. (a) Find the expression for grad φ in cylindrical coordinates.

Or

(b) Show that any square matrix can be expressed as the sum of two matrices, one symmetric and the other anti-symmetric.

13. (a) Find all the eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

Or

(b) Derive the generating function of Bessel's differential equation.

14. (a) Prove that $\beta(m,n) = \dfrac{\sqrt{m}\,\sqrt{n}}{\sqrt{(m+n)}}$

Or

(b) Show that $J_{-1/2}(x) = \sqrt{\left(\dfrac{2}{\pi x}\right)}\cos x$.

15. (a) Find the Fourier transform of e^{-ax^2}, where $a > 0$.

Or

(b) Find the Laplace transform of 4 cosh 2t sin 4t.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. State and prove Stoke's theorem.

17. Find the divergence, grad, curl and laplacian of spherical polar coordinate system.

18. Reduce the following matrix A into a diagonal matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.

19. Solve the Hermite differential equation to find its general solution.

20. State and prove the convolution theorem of Fourier transform.

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D–1600

Sub. Code
34513

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION,
MAY 2023.

First Semester

LINEAR AND INTEGRATED ELECTRONICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answers ALL questions

1. What are p – type and n – type semiconductors?

2. Draw the voltage divider bias circuit.

3. Give the advantages of LED.

4. Describe the type of FET.

5. Why is class B push – pull amplifier used as the output voltage stage?

6. What factors affects the solar cells?

7. Write the Ideal Op – Amp characteristics.

8. What is active filters and give its types?

9. Define CMRR.

10. What is the purpose of using transistor?

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) Discuss about the Zener diode as a voltage regulator.

Or

(b) Explain the principle and characteristics of tunnel diode.

12. (a) What are the three connections of transistor? Explain.

Or

(b) What is transistor amplifier? Which transistor is used as an amplifier?

13. (a) Explain the construction and working principle of SCR.

Or

(b) What is Photo detector and the characteristics? Explain.

14. (a) Discuss about the active filter.

Or

(b) Write short notes on comparator and differentiator.

15. (a) Explain Class B push pull amplifier.

Or

(b) What are the drawbacks of transformer coupled power amplifier?

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Discuss about the Op – Amp symbol, types, Equivalent circuit of IC 741 and characteristics of Op – Amp.

17. Explain the forward and reverse bias of diode and its characteristics.

18. Briefly explain the Class A, Class B and Class C operations of transistor amplifier.

19. Explain Hartley, Colpitt's oscillators and its working principle.

20. Describe the Intrinsic and extrinsic semiconductors with a neat sketch.

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D–1601

Sub. Code
34521

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Second Semester

QUANTUM MECHANICS-I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. How do you calculate the mass of meson using uncertainty relation?

2. Define matter waves.

3. What are the allowed energy eigen values of rigid rotator?

4. What do you mean by spherically symmetric potential?

5. How will you represent a state vector and its conjugate?

6. Distinguish between schrodinger and Interaction picture.

7. Give the significance of perturbation theory.

8. Define Stark effect.

9. Why the transition from 2s to 1s in the H_2 atom is strictly forbidden?

10. What is the significance of Einstein's coefficient.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) Derive time independent Schrodinger equation.

Or

(b) Show that the total probability P is conserved using the equation of continuity.

12. (a) Discuss about bound states and parity.

Or

(b) Solve the three dimensional harmonic oscillator Problem in rectangular coordinates.

13. (a) Explain the equation of motion in Heisenberg Picture.

Or

(b) Solve the linear harmonic Oscillator problem using ladder operator.

14. (a) Develop the first order time independent perturbation theory for non-degenerate case.

Or

(b) Write short notes on the principle of variational method.

15. (a) State Fermi Golden rule and derive an expression for transition probability per unit time.

Or

(b) Explain Raman Scattering using Perturbation theory.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss about the postulates of quantum. Mechanics

17. Explain the various steps by which the Schrodinger equation for Hydrogen atom can be solved and its energy levels are obtained.

18. Write about

(a) Free particle in one dimension (5)

(b) Dirac's bar and ket notation. (5)

19. Describe WKB approximation method and obtain its connection formula.

20. Explain the quantum mechanical treatment of theory of radiation.

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D–1602

Sub. Code
34522

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023

Second Semester

MATHEMATICAL PHYSICS – II

(CBCS 2018-19 Academic Year onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What is analytic function?

2. What is isolated singular point? Give an example.

3. Define mapping.

4. Give an example of self adjoint ordinary second order differential equation.

5. Mention the uses of Green's function.

6. What is contraction of tensors? Give an example.

7. Write a note on christoffel symbol.

8. What is abelian group?

9. Write the transformation law for the tensor A_r^{pq}.

10. Define classical probability.

SECTION B — (5 × 5 = 25 marks)

Answer ALL the questions. Choosing either (a) or (b)

11. (a) Describe the conformal mapping.

Or

(b) Derive Cauchy's integral formula.

12. (a) Find the sum of the residues of the function $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z| = 2$.

Or

(b) Discuss about sturm-Liouville theory.

13. (a) Obtain the solution $u(x,t)$ for the partial differential equation $\frac{\partial u}{\partial t} = 3\frac{\partial^2 u}{\partial x^2}$ has the boundary conditions are $u(o,t) = 0; u(2,t) = 0$.

Or

(b) Derive the Laplace and Poisson equation.

14. (a) Discuss the inner and outer products of tensors with examples.

Or

(b) Write a note on covariant formulation of electrodynamics.

15. (a) Construct the character table for C_{3v} point group.

Or

(b) Explain the Poisson distribution with example.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Derive the Cauchy-Riemann conditions for analytic function.

17. Evaluate $\int_0^{2\pi} \frac{\cos 2\theta}{5 + 4\cos\theta} d\theta$ by using contour integration.

18. Obtain the one dimensional wave equation for vibrating string.

19. State and prove quotient law.

20. Derive the mean and variance of binomial distribution.

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D–1603	Sub. Code
	34523

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Second Semester

ELECTROMAGNETIC THEORY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Define scalar and vector and give examples.
2. Define magnetic Flux density.
3. Write down all four Maxwell's equation.
4. What is poynting vector?
5. What is an electromagnetic wave?
6. Define total internal reflection.
7. What is meant by polarization?
8. State Brewster's law.
9. Define dispersion.
10. Describe the conditions for the existence of plasma.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Explain briefly about the transverse nature of electromagnetic wave.

Or

(b) Derive wave equation in terms of scalar and vector potential.

12. (a) Explain conservation of energy and momentum.

Or

(b) Derive Maxwell's equations.

13. (a) Explain Normal and anomalous dispersion.

Or

(b) Describe scattering and scattering parameters.

14. (a) Explain the boundary conditions at the surface of discontinuity.

Or

(b) Describe about the resonant cavities.

15. (a) Write a note on Gunn diodes.

Or

(b) Explain in detail about the occurrence of plasma.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. State and derive poynting theorem.

17. Explain the propagation of plane electromagnetic waves in free space.

18. Describe the reflection and refraction of electromagnetic waves at the interface of non-conducting media.

19. State and explain Brewster's law and derive the total interfernal reflection.

20. Derive Clasusius Mossotti relation.

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D–1604	Sub. Code
	34531

DISTANCE EDUCATION

M.Sc.(Physics) DEGREE EXAMINATION, MAY 2023.

Third Semester

MOLECULAR SPECTROSCOPY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL the questions.

1. Write two difference between Raman and FTIR spectra.

2. State Heitler London theory.

3. Give an account of SP hybrids.

4. What is dissociation energy?

5. State mutual exclusion principle.

6. State the principle of inverse Raman effect.

7. Define stimulated Raman scattering.

8. Write a block equation.

9. Define dipole-dipole interaction.

10. State Mossbauer effect.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Explain SP^2 hybridization with suitable example.

Or

(b) What is the effect of isotopic substitution on the rotational spectra?

12. (a) How do you estimate the structure of the molecule using Ramen spectroscopy?

Or

(b) Calculate the rotational energy of a diatomic molecule and discuss its spectra.

13. (a) How many normal modes of vibration can be expected in SO_2 and CO_2 molecules? Which of them are IR active? Why?

Or

(b) Discuss about the rotational Raman spectra in detail.

14. (a) What is hyper Raman effect? Give the classical treatment of hyper Ramen effect.

Or

(b) Describe in detail the Franck London principle.

15. (a) Write a detailed note on interaction between spin and magnetic field.

Or

(b) State the principle of NQR and discuss in detail its applications.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Give the Heitler-London theory for hydrogen molecule.

17. What is Portrait parabola? Explain.

18. Describe the principle and action of photo acoustic scattering.

19. Explain the vibrational spectra of diatomic molecule.

20. State the principle of mossbauer spectroscopy. How the molecular structure can be identified with the help of above technique.

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D–1605

Sub. Code
34532

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Third Semester

QUANTUM MECHANICS – II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Write down Pauli's spin matrices.

2. What is central field approximation?

3. Define identical particles.

4. Express Dirac's relativistic wave equation for free particle.

5. What are spinors?

6. Define scattering angle and scattering amplitude.

7. Differentiate field and mechanical system.

8. What do you mean by self consistent field?

9. Express D'Alembertian operator.

10. What is phase shift?

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Show that

(i) $[J^2, J_x] = 0$

(ii) $[J_2, J_+] = -\hbar J_+$

Or

(b) Write short notes on spin angular momentum.

12. (a) Show that $\left[L_x L_y, L_z\right] = i\hbar\left[L_x^2 - L_y^2\right]$

Or

(b) Write a note on Bosons and fermions.

13. (a) Derive the Dirac's relativistic wave equation for a free particle.

Or

(b) Obtain Dirac's matrices and explain its properties.

14. (a) Briefly explain spin orbit coupling.

Or

(b) Define the number operator N_k and show that the eigen values for a system of Fermions are 0 and 1.

15. (a) How do we quantize any field and what are the elements of field quantization?

Or

(b) Elucidate the validity of Born Approximation.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Describe the Hartree Fock method of central field approximation.

17. Explain doublet separation in alkali atoms.

18. How do you quantize an electromagnetic field?

19. Apply Born approximation to the scattering problem and obtain an expression for total cross section.

20. Explain the scattering by screened coulomb potential and obtain the Rutherford formula.

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D–1606

Sub. Code
34533

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Third Semester

MICROPROCESSOR AND ELECTRONIC INSTRUMENTATION

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Define microprocessor.

2. What is register organization?

3. What is stack?

4. Give the difference between address and data bus.

5. Define instruction cycle.

6. Write any two types of addressing mode of 8086.

7. What is operand?

8. Draw a neat sketch of comparator.

9. List some of the applications of microprocessor based system.

10. Give the principle of photovoltaic cell.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Explain the addressing modes in 8085.

Or

(b) Discuss the minimum mode operation of 8086.

12. (a) Explain the stack operation in 8085.

Or

(b) With the neat pin configuration explain the operation of 8086 microprocessor.

13. (a) Draw a neat flow chart and explain the logical program of 8051.

Or

(b) Discuss the special function register of 8051.

14. (a) Write a note on temperature monitoring.

Or

(b) Explain any one classification of transducers.

15. (a) Discuss the programmable interrupts in 8259.

Or

(b) Write about any one type of photoelectric transducer.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. With a neat block diagram explain the 8085 architecture.

17. Explain the various types of instruction set in 8085.

18. Elaborately explain the programmable communication interface in 8251.

19. Explain the operation of LVDT transducers with its diagram.

20. Write a brief notes on

    (a) Photo electric Transducers.

    (b) Piezoelectric Transducers.

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D–1607	Sub. Code
	34541

DISTANCE EDUCATION

M.Sc.(Physics) DEGREE EXAMINATION, MAY 2023.

Fourth Semester

CONDENSED MATTER PHYSICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL the questions.

1. Draw neatly the crystal planes of (111) and (010)

2. What are the difference between the crystalline and amorphous solids? With suitable example.

3. Define Bravais lattice.

4. Define Diatomic lattice.

5. How do determine the fermi energy level in semiconductor?

6. Give short notes on ferroelectric properties of crystal.

7. Difference between the ferro and anti ferromagnetism.

8. List out the properties of ferrites.

9. How relate the isotope effect in super conductivity.

10. Which energy level do electrons in cooper pairs occupy.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) Discuss about the various crystal system and crystal symmetry operations.

Or

(b) Briefly explain the simple cubic (SC) crystal system.

12. (a) Discuss the kroning-penny model for the motion of an electron in a periodic potential.

Or

(b) Derive the expression of classius-Mosotti relation.

13. (a) Explain the weiss molecular field theory of ferromagnetism.

Or

(b) Difference between the Hard and soft magnetic materials.

14. (a) Calculate the critical Neel's temperature of antiferromagnetism.

Or

(b) What is superconductors? Discuss about type I and type II Superconductors.

15. (a) Explain Meissner effect with necessary diagram.

Or

(b) Discuss about formation of cooper pairs and fermi energy gap in superconductor on the basis of BCS theory.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Briefly discuss about BCC and FCC crystal system.

17. Discuss about the piezo, pyro and ferro electric properties of crystals.

18. Define local field. Derive the expression for lorentz internal field.

19. Explain langevin's classical theory of paramagnetism. Hence obtain an expression for paramagnetic susceptibility.

20. Briefly discuss about the high temperature super conductor.

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D–1608

Sub. Code
34542

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Fourth Semester

NUCLEAR AND PARTICLE PHYSICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL the questions.

1. What is magic numbers?

2. Explain the selection rules of β – decay.

3. Define nuclear fusion.

4. Write the properties of deuteron.

5. State thermo nuclear reaction.

6. What is meant by thermal neutrons?

7. Write a note on sources of stellar energy.

8. What is iso spin?

9. Write a note on Leptons.

10. Define Gel – Mann – Nishijima formula.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) What do you understand by the term nuclear isomerism of gamma rays? Explain.

Or

(b) Give an account on parity violation in β – decay.

12. (a) Give the theory of nuclear quadrupole moment.

Or

(b) Discuss the features of the collective nuclear model.

13. (a) Discuss the theory on nucleon – nucleon potential.

Or

(b) How the mass of π – meson is determined from meson's theory of nuclear forces.

14. (a) Discuss in detail about the carbon – nitrogen cycle.

Or

(b) Derive four factor formula.

15. (a) Write a note on

(i) Quarks (ii) Baryons

Or

(b) Explain Su (2) symmetry groups.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the Gomow's theory of α – decay.

17. What are neutrinos? Discuss the theory of neutrinos.

18. Give the simple theory of deuteron.

19. Describe the theory of a compound nucleus formation and to its decay.

20. What are the fundamental forces in nature? Explain.

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D–1609	Sub. Code
	34543

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2023.

Fourth Semester

MATERIAL SCIENCE

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Define tensile strength and hardness.

2. State postulates of kinetic theory of gas.

3. Define lattice misfit.

4. How will you confirm CO_2 laser is multi level laser?

5. Define spontaneous and stimulated emission in laser?

6. Define the role of optical resonator in laser production.

7. What are metal — matrix composites.

8. List out the application of cement — matrix composites in civil structural field.

9. Distinguish amorphous and glassy materials.

10. Define: Micro actuators.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Explain the role of temperature in creep and fatigues.

Or

(b) Explain in short any two properties of polymers.

12. (a) Write a short note on corrosion resistance materials.

Or

(b) What are vacuum pumps? give its applications.

13. (a) How will you use Quartz crystal method to measure thickness of the films?

Or

(b) Briefly explain the term structural aspects.

14. (a) Describe in short — semiconductor laser.

Or

(b) State and explain the working of Nd — YAG laser.

15. (a) Explain working mechanism of SMA.

Or

(b) Write a short note on Nitinol.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. With the neat illustration, explain in detail polymerization.

17. Discuss in detail epitaxy of compound semiconductors.

18. Calculate the degrees of freedom for CO_2. Discuss in detail CO_2 lasers.

19. Write a short note on

    (a) Second harmonic generators

    (b) Electro-Optic modulators

20. With neat illustration and mechanism, explain in detail any one preparation for SMA.

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