DEPARTMENT OF PHYSICS
GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG

Programme Outcomes (POs)

At the end of M. Sc. (Physics) students will be able to:

PO1: Knowledge: Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

PO2: Complementary skills: Students will be able to engage in critical investigation through principal approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies

PO3: Applied learning: Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

PO4:Communication: Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentations by oral and/or written form.

PO5: Problem-solving: Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

PO6: Environment and sustainability: Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO7: Teamwork, collaborative and management skills: Recognize the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Programme Specific outcomes

At the end of M. Sc. (Physics) students will be able to:

PSO1 Students are expected to acquire core knowledge in modern physics, including the major premises of classical mechanics, electromagnetic theory, and optical electronics.

PSO2 Students are also expected to develop written and oral communication skills in optical fibre communicating physics-related topics.

PSO3 Students would learn how to design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes.

PSO4 Students are expected to understand the analytical methods required to interpret and analyze results and draw conclusions as supported by the experimental data or existing theories.

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Alumni (member).....	3. Dr. Anita Shukla .....
Prof. from other Dept. of Sc. Faculty	4. Dr. Siteshwari Chandraker .....
Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
	6. Dr. Kusumanjali Deshmukh.....

DEPARTMENT OF PHYSICS
GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG
Approved Syllabus for M.Sc. (PHYSICS) Semester I by the members of Board of Studies
For the Session 2024-25

Semester I

The syllabus with the paper combinations is as under

Paper I MPH101: MATHEMATICAL PHYSICS	**Paper II MPH102: CLASSICAL MECHANICS**
Paper III MPH103: QUANTUM MECHANICS	**Paper IV MPH104: ELECTRONIC DEVICES AND DIGITAL ELECTRONICS**
Paper V MPHL01: Lab Course I General	**Paper VI MPHL02: Lab Course II Microprocessor 8085**

Name and Signatures

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	6. Dr. Kusumanjali Deshmukh.....

Marking Scheme for M.Sc. (PHYSICS) Semester I
Session 2024-25

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max.	Min.	Max.	Min.	
I	MPH101: Mathematical Physics	80	16	20	04	05
II	MPH102: Classical Mechanics	80	16	20	04	05
III	MPH103: Quantum Mechanics	80	16	20	04	05
IV	MPH104: Electronic Devices and Digital Electronics	80	16	20	04	05
V	MPHL01: Lab Course I General	100	34	…….	……..	04
VI	MPHL02: Lab Course II Microprocessor 8085	100	34	……..	……..	04
	Total	520	……	80	…….	28

04 Theory papers	-	320
04 Internal Assessments	-	80
02 Practical	-	200
Total Marks	-	600

20 marks = 01 credits in Theory Papers and
25 marks = 01 credits in Practical

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The Scheme of Internal Assessment
Session 2024-25
M.Sc. (PHYSICS) Semester I

Paper No.	Paper Name	Test Marks I	Test Marks II	Home Assignment/ Seminar III	Total
I.	MPH101: Mathematical Physics	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
II.	MPH102: Classical Mechanics	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
III.	MPH103: Quantum Mechanics	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
IV.	MPH104: Electronic Devices and Digital Electronics	20 Marks	20 Marks	Only one seminar (20 marks) Presentation (10 marks) Viva (10marks)	Average of Best of Test and Home Assignment/ Seminar(20 Marks)

Note: Compulsory submits one hardcopy and softcopy of ppt after presentation.

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Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination have the following main points
The question paper will be of **80 marks**

1. Questions will be asked Unit-wise in each question paper.
2. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus, there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Two Internal Test in each paper (20 marks).
   ii. Seminar (Power point presentation) in any one of the papers (20 marks).
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar) (20 marks).
   iv. Average of marks obtained in best of internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT.V.Y.T. P G AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester - I
Paper - I
MPH101: MATHEMATICAL PHYSICS

COURSE OUTCOMES

After completion of the course, students would able to:

CO1 Determine the continuity, differentiability of functions, find the complementary function of PI and LDE.

CO2 Learn to derive solution by series expansion and Legendre, Bessel's, Hermite and Lagurre equation and physical applications of Legendre, Hermite and Lagurres polinomials.

CO3 Analyze - Basic idea of Group, finite and infinite decimal Vector space and Subspace. Basic idea about matrix Compute eigen Values and eigen vectors, characteristic polynomials and apply to basic digonalization of matrix

CO4 Distinguish the integral of infinite order into general and singular integrals. Solve and apply linear equation of order two and higher LDE using Laplace's Transformation. Perform Transforms like Laplace's Transformation, Fourier series, Fourier Transformations. Get familiar with the modelling assumption and derive the idea to PDE.

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GOVT.V.Y.T. P G AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester - I
Paper - I
MPH101: MATHEMATICAL PHYSICS

Min. Marks: 16 **Max. Marks: 80**

UNIT-I Basic idea of Group, Finite and infinite group, Identity element, Groups of Vector, Ordered set of numbers, Linear dependence and independence of Vector, Properties of linearly independent and dependent System, subspace
Subspace of n- Vector s, Vector field, orthonormal vectors, orthonormalzation by Scmidts orthogolization method linear transformation of the space, Vector space of n-tuplets, Inner product space, linear transformation, homogeneous and non homogeneous transformation. full linear transformation of a quadratic form,

UNIT-II **MATRICES –** Real, symmetric and hermition matrices. matrices with polynomial elements the inverse matrix, orthogonal matrix, independent element of an orthogonal matrix, unitary matrix, independent element of a unitary matrix, Eigen Values and eigen vectors, Digonalization of matrix. Linear equation, Solution of linear equation by Cramer's rule.

UNIT-III **Special Functions-** Solution of second order linear differential equation with constant coefficients, Second orders linear ODEs with variable coefficient, Series intregation method of the solution of linear differential equation (Frobenius method), Solution by series expansion and Legendre, Bessel's, Hermite and Lagurre equation, Physical applications, Generating Functions, recurrence formulae, orthogonality, Rodrigueues formula of Legendre, Hermite and Laguerre polynomials.

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UNIT-IV **Integral Transform –** Laplace's Transformation - Definition of Laplace's transform sectional or piecewise continuity, functions of exponential order, sufficient condition for existence of Laplaces transfrom, first and second shifting theorem, change of scale property, LT of derivatives and LT of integrals, Inverse LT definition and properties, Inverse LT by Partial fraction, Fourier series, Fourier Transform definition properties linearty theorem similarty theorem and Conjugate theorem, Fourier Transform of derivatives.

REFERENCES :

1. Laplaces Transfrom by Murray R.S.Spiegel
2. Special function by J.N.Sharma
3. Matrix & Tensors in Physics by R.K.Gupta , A.W.Joshi
4. A.Text book of Matrices by Shanti Narayana.
5. Mathematical method for engineering and physicist. By A.K.Mukhopadhyay.
6. Introduction to mathematical physics by Charlie Harper.
7. Advanced Engineering Mathematics by Jain and Iyenger.
8. Higher Engineering Mathematics by H.K. Das.

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GOVT.V.Y.T. P.G. AU TONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-I
Paper - II
MPH102: CLASSICAL MECHANICS

Course Outcomes
After completion of the course, students would able to:

CO1 Know the effect of forces during static conditions and understand the true nature of Newtonian mechanics, Lagrangian and Hamiltonian approaches in classical mechanics.

CO2 Apply Langragian Equation and solve Kinematics and Dynamics of rigid body in detail and ideas regarding Euler's equations of motion

CO3 Reduce dynamics of many body problem to single body and apply it to solve Planetary Motions

CO4 Understand Principle of least action and transformations from one set to another and implement it to theory of small oscillations in detail along with basis of Free vibrations

Name and Signatures

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GOVT.V.Y.T. P.G. AU TONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-I
Paper - II
MPH102: CLASSICAL MECHANICS

Min. Marks: 16 **Max. Marks:80**

UNIT-I Preliminaries, Newtonian mechanics of one and many particle system; conservation laws. Working theorem, Constraints, their classification principle of virtual work, The basic problem with constraint forces. D'Alemberts principle, degree of freedom, generalized coordinates.

UNIT-II Lagrange's equations, Jacobi integral Generalized moment and energy. Gauge function for Lagrangian integrals of motion, concept of symmetry, symmetries of space and time with conservation laws, invariance under Galilean transformation, Special theory of relativity- Lorentz transformations, relativistic kinematics and mass–energy equivalence.

UNIT-III Rotating frames, inertial forces, Electromagnetic analogy of the inertial forces terrestrial and astronomical applications of coriolis force.
Central force. Two body problem, stability of orbit, conditions for closure, Kepler 's equation, orbits of artificial satellites.

UNIT- IV Principle of least action, Hamilton's Principle and characteristic function H-J (Hamilton Jacobi) equation canonical Transformation, Generating Function, Poisson bracket, Poisson theorem, Study of small oscillations using generalized coordinates.

REFERENCES:

1. Classical Mechanics by H.Goldestein
2. Classical Mechanics by N. C.Rana & P.S. Joag
3. Classical Mechanics by J. C. Upadhyaya
4. Classical Mechanics by Gupta Kumar
5. Classical Mechanics by Pouranic

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-I
Paper - III
MPH103: QUANTUM MECHANICS

Course Outcomes

After completion of the course, students would able to:

CO1 Get familiarize with basic non-relativistic quantum mechanics, old quantum theory, interpretation of wave function, uncertainty principle in quantum mechanics and commutation relations.

CO2 Appreciate Dirac delta function, box normalization, Hilbert space, matrix mechanics, Schrodinger, Heisenberg and interaction pictures, particle in a box, tunneling through a potential barrier, linear harmonic oscillator.

CO3 Develop the idea of symmetry in space and time, spherical harmonics, angular momentum, addition of angular momenta and Clebsch-Gordon coefficients.

CO4 Understand the basic concepts of hydrogen atom in quantum mechanics, time independent perturbation theory and its applications to harmonic oscillator, Zeeman effect without spin and Stark effect.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-I
Paper - III
MPH103: QUANTUM MECHANICS

Min. Marks: 16 **Max. Marks: 80**

UNIT-I **Origin of Quantum Mechanics** : Born's statistical and Bohr-Heisenberg (Copenhagen) interpretations of wave function, Superposition of states and collapse of wave function, Schrodinger cat experiment, EPR paradox.

Mathematical Formalism : Linear vector space, Wave function as a vector in Hilbert space, Dirac's bra and ket notations, orthogonality and completeness conditions, Observables and operators, Properties of Hermitian operators, Expectation values, Unitary transformations, Position and momentum representation, Ehrenfest's theorem, Dirac delta function.

UNIT-II **Uncertainty principle** : Heisenberg uncertainty principle, its theoretical proof an applications.

Quantum Dynamics : Rectangular potential barrier and tunneling, Linear Harmonic oscillator solution using creation and annihilation operators, Schrodinger, Heisenberg & Interaction pictures.

UNIT-III **Angular momentum** : Definition of angular momentum, eigenvalues and Eigen functions of orbital and total angular momenta, Spherical harmonics, Angular momentum matrices, Spin and parity operators, symmetry and conservation principle, Pauli spin matrices, Addition of two angular momenta, Clebsch- Gordon coefficients for $j_1 = j_2 = 1/2$.

UNIT-IV **Hydrogen Atom** : Radial equation, asymptotic solution, eigen values and eigen functions, degeneracy; Laguerre polynomials.

Perturbation Theory : Time independent perturbation theory – non-degenerate and degenerate cases, removal of degeneracy, applications to (i) harmonic oscillator, (ii) first order Stark effect in hydrogen and (iii) Zeeman effect without electron spin.

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REFERENCES :

1. Introduction to Quantum Mechanics by David J. Griffiths
2. Quantum Mechanics by B. H. Bransden and C. J. Joachain
3. Quantum Mechanics by L. I. Schiff
4. Quantum Mechanics : Concepts & Applications by Nouredine Zettili
5. Quantum Mechanics : Non-relativistic Theory by L. D. Landau & E.M. Lifshitz
6. Quantum Mechanics by Mathews and Venkatesan.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-I
Paper - IV
MPH104: ELECTRONIC DEVICES AND DIGITAL ELECTRONICS

Course Outcomes

After completion of the course, students would able to:

CO1	Understand transistor and diode characteristics and apply it to design electronic circuits and microwave devices of desired configurations.
CO2	Identify and model various Photonic devices, their working principle and applications in numerous present day technologies.
CO3	Implement laws of Boolean algebra for reduction for various logic circuits and create K-Map.
CO4	Recognize microprocessor 8085 and its basic working along with familiarization of all type of memory devices.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR 2024-25
M.Sc. (Physics) Semester-I
Paper - IV
MPH104: ELECTRONIC DEVICES AND DIGITAL ELECTRONICS

Min. Marks: 16 **Max. Marks.:80**

UNIT-I **Transistors:** - BJT, JFET, MOSFET and MESFET: Structure working, Derivation of the equation for I-V characteristics under different condition.

Microwave Devices: - Gunn diode (Transferred Electron Devices), Transit time devices—IMPATT diodes, TRAPATT Diode.

UNIT-II **Photonic Devices** - Radiative and non-radiative transition, optical Absorption bulk and thin film, photo conductive device (LDR), Photo detectors, solar cell open circuit voltage and short circuit current LED (high frequency limit effect of surface and indirect recombination current, operation of LED) laser condition for population inversion in active region, light confinement factor, optical gain.

UNIT-III **Digital Electronic Devices:** Logic gates: OR, AND, NOT, NAND, NOR, Ex-OR, Ex-NOR GATES, Number system: binary numbers, binary to decimal conversion, decimal to binary conversion, binary addition, binary subtraction, 1's compliment, 2s compliments, binary multiplication and division, octal and hexadecimal numbers, BCD code and gray code. Boolean Algebra: De Morgen's theorem, laws and theorems of Boolean algebra, sum of product and product of sums simplification, Karnaugh map simplification.

UNIT-IV **Memory Devices:** RAM, ROM, PROM, EPROM, A/D and D/A converters, Static and dynamic random access memories (SRAM and DRAM), NMOS and CMOS, charge coupled devices (CCD) Microprocessor: introduction to a microprocessor. INTEL 8085 Architecture and pin diagram, CPU, Instruction set for 8085 microprocessor and programs.

Name and Signatures

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REFERENCES:

1 Handbook of Electronics by Kumar & Gupta.

2 Principles of Electronics by V.K. Mehta.

3 Fundamental; of Digital Circuit by A. Anand Kumar.

4 Digital Electronics by R.P. Jain.

5 Microprocessor by Vibhute.

6 8085 microprocessor by Ramesh Gaonkar.

7 Microwave devices and circuits by Samuel Y. liao.

8 Microwave & Radar Engineering by M. Kulkarni.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- I
Paper V
MPHL01: LAB-COURSE I - GENERAL

Course Outcomes

Students are expected to understand various theory and principles concerned with mechanics, semiconductor electronics and Optics and will be able to do the following in connection of the same.

CO1 Design and resolve circuits for electronic applications.

CO2 Record data as required by the experimental objectives.

CO3 Analyse recorded data and formulate it to get desired results.

CO4 Interpret results and check for attainment of proposed objective.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- I
Paper V
MPHL01: LAB-COURSE I - GENERAL

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

The following experiments or similar experiments of equal standard are to be performed

1. Study of temperature dependence of resistivity of a semiconductor by four probe method.
2. Determination of Lande's factor of DPPH using Electron Spin Resonance (ESR) Spectrometer.
3. Measurement of Hall Co-efficient to identify p or n type semiconductors.
4. Determination of Young's modulus "Y" by Newton's Rings.
5. Determination of Young's modulus "Y" by Carno's method.
6. Determination of "e/m" by Millican's oil drop method.
7. Calibration of drum of a Constant Deviation Spectrometer.
8. Verification of Fresnel's formula.
9. Study of characteristics of negative temperature coefficient Thermister.
10. Analysis of elliptically polarized light by Babinet's Compensator.
11. Determination of refractive index of a liquid Abbe's refractometer.
12. Determination of numerical aperture and bending loss of an Optical fiber.
13. Photoconductivity rise and decay studies and determination of photoconductivity gain.
14. Photo diode characteristics.
15. Photo Transistor characteristics.
16. Determination of Planck Constant with the help of a photo cell.
17. To determine the dielectric constant and permittivity of a solid by resonance method.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- I
Paper VI
MPHL02: LAB-COURSE I I – MICROPROCESSOR 8085

Course Outcomes

Students are expected to understand various working and application of microprocessor and will be able to:

CO1	Write a program in assembly language for a given problem statement
CO2	Implement of various mathematical operations through the program.
CO3	Validate the outputs obtained from the program.
CO4	Formulate mathematical operation for any Problem.

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Alumni (member).....	3. Dr. Anita Shukla .....
Prof. from other Dept. of Sc. Faculty	4. Dr. Siteshwari Chandraker .....
Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
	6. Dr. Kusumanjali Deshmukh.....

GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- I
Paper VI
MPHL02: LAB-COURSE I I – MICROPROCESSOR 8085

Min. Marks: 33 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

1. Write a program to add two 8-bit numbers.
2. Write a program to subtract two 8 bit numbers.
3. Write a program to multiply two 8 bit numbers.
4. Write a program to divide two 8 bit numbers.
5. Write a program to add ten data bytes.
6. Write a program to transfer a block of data in forward order.
7. Write a program to transfer a block of data in reverse order.
8. Write a program to arrange data in ascending order.
9. Write a program to arrange data in descending order.
10. Write a program to find positive numbers in an array.

References

1.Microprocessor Architecture, Programming and Application with the 8085- Ramesh Gaonkar
2.8085 Microprocessor and its Application – Nagoor Kani

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DEPARTMENT OF PHYSICS
GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG
Approved syllabus for M.Sc. (PHYSICS) Semester II by the members of Board of Studies
For the Session 2024-25

Semester II

The syllabus with the paper combinations is as under

Paper I **MPH201: QUANTUM MECHANICS**	**Paper II** **MPH202: STATISTICAL MECHANICS**
Paper III **MPH203: ELECTRODYNAMICS**	**Paper IV** **MPH204: ATOMIC AND MOLECULAR PHYSICS**
Paper V **MPHL03: Lab Course I** **Electronics**	**Paper VI** **MPHL04: Lab Course II** **C - Programming**

*** Applicable for the concerned subjects**
The syllabus for M.Sc. (PHYSICS) II Semester is hereby approved for the session 2024-25.
For PG classes there is provision for Educational tour/ Study tour in renowned institutions

Name and Signatures

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Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

Marking Scheme for Second Semester
Session 2024-25

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment	
		Max	Min	Max.	Min.
I	MPH201: Quantum Mechanics	80	16	20	04
II	MPH202: Statistical Mechanics	80	16	20	04
III	MPH203: Electrodynamics	80	16	20	04
IV	MPH204: Atomic And Molecular Physics	80	16	20	04
V	MPHL03: Lab Course I Electronics	100	34	-	-
VI	MPHL04: Lab Course II C-Programming	100	34	-	-
	Total	520		80	

04 Theory papers	-	320
04 Internal Assessments	-	80
02 Practical	-	200
Total Marks	-	600

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The Scheme of Internal Assessment
Session 2024-25
Semester II

Paper No.	Paper Name	Test Marks I	Test Marks II	Home Assignment III	Total
I	MPH201: QUANTUM MECHANICS	20 Marks	20 Marks	20 Marks	Average / Best of Test and Home Assignment/ Seminar(20 Marks)
II	MPH202: STATISTICAL MECHANICS	20 Marks	20 Marks	Only one seminar (20 marks) Presentation (10 marks) Viva (10marks)	Average / Best of Test and Home Assignment/ Seminar(20 Marks))
III	MPH203: ELECTRODYNAMICS	20 Marks	20 Marks	20 Marks	Average / Best of Test and Home Assignment/ Seminar(20 Marks)
IV	MPH204: ATOMIC AND MOLECULAR PHYSICS	20 Marks	20 Marks	20 Marks	Average / Best of Test and Home Assignment/ Seminar(20 Marks)

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Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination have the following main points
The question paper will be of **80 marks**

1) Questions will be asked Unit-wise in each question paper.
2) From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1) Question no. 1 and Question 2 will be compulsory.
2) Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3) As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4) Internal Assessment Examination will be as follows:
   i) Two Internal Test in each paper (20 marks).
   ii) Seminar (Power point presentation) in any one of the papers (20 marks).
   iii) Assignment in each of the remaining papers (excluding the paper of Seminar(20 marks).
   iv) Average of marks obtained in best of internal test + seminar in any one paper and marks obtained in best of internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT.V.Y.T.AUTO.PG COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-II
Paper - II
MPH201: QUANTUM MECHANICS

Course Outcomes

After completion of the course, students would able to:

CO1	Familiarize with time independent perturbation theory and Fermi-Golden rule, variation method, WKB approximation as well as adiabatic and sudden approximations.
CO2	Introduce laboratory and centre of mass frames, scattering cross-sections, partial wave analysis, Born approximation.
CO3	Develop the idea of identical particles in quantum mechanics and their collision, spin angular momentum, Pauli pin matrices, effect of identity and spin.
CO4	Understand the basic concepts of semi classical theory of radiation and electric dipole transition, line width, quantization of electromagnetic field, creation and annihilation operators, spontaneous and stimulated emissions.

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GOVT.V.Y.T.AUTO.PG COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-II
Paper - II
MPH201: QUANTUM MECHANICS

Min. Marks: 16 **Max. Marks.: 80**

UNIT- I Time dependent perturbation theory, Harmonic perturbation, Fermi's golden rule, Variational method and its application to calculate expectation value of the energy, WKB approximation theory and its applications, adiabatic and sudden approximations.

UNIT-II Scattering in laboratory and center of mass reference frames, scattering amplitude, differential scattering cross section and total scattering cross section, Spherically symmetric potentials, partial wave analysis and phase shifts, scattering by perfectly rigid sphere and by square well potential, Greens function, Born appximation, validity of Born approximation**.**

UNIT-III Identical particles, Exchange operator, Symmetric and anti-symmetric wave functions, Slater determinant, Pauli's exclusion principle, Collision of identical particles, Electron spin function.

Relativistic Quantum Mechanics: Klein-Gordon (KG) equation and its plane wave solution and equation of continuity, Dirac equation for free particle, Plane wave solutions of Dirac equation, charge and current densities, Covariant form of Dirac equation, Dirac interpretation of negative energy states and concept of antiparticles, Dirac γ- matrices and their properties.

UNIT-IV Hamiltonian and interaction term in the semi-classical theory of radiation, transition probability for absorption and induced emission, electric dipole transition, forbidden transition, Spontaneous and stimulated emission, Plank's distribution formula, line breadth, selection rules, quantization of electromagnetic field using creation and annihilation operators, transition rates for absorption and emission of radiation, Dipole approximation – transition rates with dipole approximation, electric dipole selection rules, spontaneous and stimulated emission.

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REFERENCES :

1. Introduction to Quantum Mechanics by L. Pauling & E. B. Wilson
2. Quantum Mechanics by V. K. Thankappan
3. Quantum Mechanics by L. I. Shiff
4. Quantum Mechanics - Non-relativistic Theory by L. D. Landau & E. M. Lifshitz
5. Modern Quantum Mechanics by J. J. Sakurai.
6. Quantum Mechanics – Concepts & Applications by Nouredine Zettili
7. Quantum Mechanics by Mathews and Venkatesan.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG(C.G.)
2024-25
M.Sc. (Physics) Semester-II
Paper - II
MPH202: STATISTICAL MECHANICS

Course Outcomes

After completion of the course, students would able to:

CO1 Classify a system into canonical, micro canonical, Grand Canonical ensembles and write partition function for them.

CO2 Describe Gibbs's paradox, Phase space Liouvelle's theorem, Maxwellian distribution from canonical distribution and understand transition to Quantum statistical mechanics.

CO3 Derive and discuss Virial equation , cluster expansion for a classical gas,the Ising model in one dimension, exact solution of Ising model in one dimensions and Landau's Phenomenological theory of phase transition.

CO4 Summarize and outline thermodynamic fluctuations spatial correlation in a fluid, Langevin's theory of the Brownian motion, Einstein Relation and Expression for mobility(Nernst relation) Fokker – Planck equation and Fluctuation dissipation theorem.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG(C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-II
Paper - II
MPH202: STATISTICAL MECHANICS

Min. Marks: 16 **Max. Marks.: 80**

UNIT-I **Foundation of statistical mechanics** – Specification of the state of a system statistical ensemble, contact between statistical and thermo dynamical quantities, Micro canonical ensemble, perfect gas in micro canonical ensemble, partition function and its correlation with thermodynamic quantities nature of probability function partition function for canonical ensemble thermodynamic functions for canonical ensemble. Perfect mono atomic gas in canonical ensemble, Grand canonical ensemble: Partition function and thermo dynamic function for grand canonical ensemble, Perfect gas in grand canonical ensemble.

UNIT-II Classical ideal gas entropy of mixing, Gibbs's paradox, Phase space Liouvelle's theorem, Maxwellian distribution from canonical distribution, Transition from classical statistical mechanics to quantum statistical mechanics, indistinguishability and quantum statistics.
The density matrix, condition for statistical equilibrium, B.E., F.D. & M.B. statistics evaluation of constant α and β , Result of three statistics, Properties of ideal Bose gas, gas degeneracy, B.E. condensation, ideal fermi dirac gas – energy & pressure of gas & light and strong degeneracy.

UNIT-III **Theory of imperfect gases** – Virial equation of state Virial coefficients, cluster expansion for a classical gas. The Ising model in one dimension, exact solution of Ising model in one dimensions Phase transition, Phase transition of first and second kind, Landau's Phenomenological theory of phase transition.

UNIT-IV **Fluctuations –** Thermo dynamic fluctuations spatial correlation in a fluid, The Langevin's theory of the Brownian motion, Einstein Relation and Expression for mobility (Nernst relation) Fokker – Planck equation, Fluctuation dissipation theorem.

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REFERENCES:

1 Statistical and thermal Physics by F.Reif.
2 Statistical Mechanics by K.Huang.
3 Statistical Mechanics by R.K.Patharia.
4 Statistical Mechanics by Landau & Lifshiz.
5 Statistical Mechanics by Bhattacharya.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-II
Paper - III
MPH203: ELECTRODYNAMICS

Course Outcomes

After completion of the course, students would able to:

CO1 Review and illustrate Lorentz transformation of space and time and Maxwell's field equations in terms of four vectors, electromagnetic field tensor, Lienard -Wiechert Potential.

CO2 Explain Motion of charged particles in E-M field and theories related to Larmour's formula, relativistic generalization of Larmour's formula, Bremrstrahlung radiation, Synchrotron Radiation, Cerenkev radiation, Abraham- Lorentz formula.

CO3 Explain propagation of EMW in free space and extend the idea for conducting and dielectric media and hence build the concept of wave guide and its modes.

CO4 Implement Lagrangian for EMW and analyze results obtained for interacting particles

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-II
Paper - III
MPH203: ELECTRODYNAMICS

Min. Marks: 16 **Max. Marks: 80**

UNIT-I Review of four vectors, Lorentz transformation of space and time in four-vector form. Maxwell's field equations in terms of four vectors, vector potential and scalar potential, electromagnetic field tensor, Maxwell's equations in covariance four tensor form, Lorentz Transformation of electric and magnetic Fields, The invariants of the electromagnetic field, Retarded potential, Lienard Wiechert potentials.

UNIT-II Electric and Magnetic fields due to a uniformly moving charge, variation of accelerated charge at low velocity - Larmour's formula, relativistic generalization of Larmour's formula, Bremrstrahlung radiation, Synchrotron Radiation, Cerenkov radiation, Angular distribution of radiation emitted by an accelerated charge, radiation damping- Abraham- Lorentz formula.

UNIT-III **Electromagnetic waves and its interaction with matter on macroscopic scale :** Electromagnetic waves (EMW) in free space, propagation of EMW in isotropic, anisotropic dielectrics, in conducting media, Boundary conditions, Fresnel formulae, Propagation of EMW between conducting planes, Wave guides : TE and TM mode, Rectangular and cylindrical wave guides, cavity resonator.

UNIT-IV **Lagrangian Formulation of Electrodynamics :** Lagrangian for a free relativistic particle, for a charge particle in an e.m. field, for free electromagnetic field, for interacting charged particles and fields, Energy-momentum tensor and related conservation laws.

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REFERENCES :

1. Introduction to Electrodynamics by David J. Griffith
2. Classical Electricity & Magnetism by Panofsky & Phillips.
3. Classical Electrodynamics by J.D. Jackson.
4. Principles of Electrodynamics by Melvin Schwartz,
5. Classical Electrodynamics by J. Schwinger, L.L. Derrad, K.L. Milton, W.Y. Tsai, J. Norton.
6. Modern Problems in Classical Electrodynamics by Charles A. Brau,
7. Electrodynamics of Continuous Media by L. D. Landau and E. M. Lifshitz and L.P. Pitaevskii,
8. Electrodynamics : An introduction including quantum effects by H.J.W. Mueller-Kirsten.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-II
Paper-IV
MPH204: ATOMIC AND MOLECULAR PHYSICS

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	know about different atom model and will be able to differentiate different atomicsystems, different coupling schemes and their interactions with magnetic and electric fields.
CO2	Have gained ability to apply the techniques of microwave and infraredspectroscopy to elucidate the structure of molecules
CO3	Be able to apply the principle of Raman spectroscopy and its applications in the differentfield of science & Technology.
CO4	To become familiar with different resonance spectroscopic techniques and its applications to find solutions to problems related different spectroscopic systems.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-II
Paper-IV
MPH204: ATOMIC AND MOLECULAR PHYSICS

Min. Marks: 16 **Max. Marks: 80**

UNIT-I Stationary energy states, radiation terms, continuous spectra, quantum numbers of the individual electrons the Pauli's Principle, quantum theoretical addition of angular momentum vectors, quantum numbers and angular momentum of the whole atom, term Symbols, influence of a magnetic or electric field, selection rules, nuclear spin.

UNIT-II Atomic Orbital, Hydrogen Spectrum (Bohr theory, Sommerfeld theory and Sommerfeld Relativistic Correction), Spectrum of alkali elements Different Series of Alkali atoms , spin orbit interaction & fine Structure in alkali spectra , Normal and anomalous Zeeman effect, Paschen Back effect, Stark effect, Two electron system, Interaction energy in LS and JJ coupling.

UNIT-III The rigid rotator – The molecules as a rigid rotator, energy eigen values, Eigen function, spectrum. The non-rigid rotator energy levels,
The diatomic molecules as symmetric to, asymmetric top and spherical top molecule, angular momenta, energy levels, Eigen functions, infrared spectrum.

UNIT-IV The diatomic molecule as anharmonic oscillator, energy levels, Eigen functions, spectrums. Molecules as Vibrating rotator, Vibration spectrum of diatomic molecule, P, Q and R branches, Applications of vibrational spectroscopy.
Infra-red spectrum, general experimental arrangement for studying infrared spectra.

REFERENCE:

1. Introduction to atomic spectra- H.E.White
2. Fundamental of spectroscopy – C.B.Banwell.
3. Spectra of diatomic molecules – Herzbeng
4. Molecular structure & Spectroscopy – G.Aruldhas.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- II
Paper - V
MPHL03: LAB-COURSE I ELECTRONICS

Course Outcomes

Students are expected to understand various theory and applications concerned with semiconductor electronics and will be able to :

CO1 Design and resolve circuits for electronic applications.

CO2 Record data as required by the experimental objectives.

CO3 Analyse recorded data and formulate it to get desired results.

CO4 Interpret results and check for attainment of proposed objective.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- II
Paper - V
MPHL03: LAB-COURSE I - ELECTRONICS

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

Any 10 of the following or similar experiments of equal standard are to be performed.

1. Design of Regulated Power supply.
2. Design of C-E Amplifier.
3. Design & Study of Negative feed back amplifier. (Voltage & Current)
4. Design & Construction of Astable, Monostable, Bistable Multivibrators.
5. Characteristics & applications of S.C.R.
6. FET & MOSFET Characterization and Application as an Amplifier.
7. Study of UJT & its application.
8. Digital-I Basic logic Gates, T.T.L.NAND, NOR gates.
9. Digital-II Combinational Logic Gates.
10. Flip- Flop's : J K, RS
11. Application of Operational Amplifier (741)
12. Differential Amplifier.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- II
Paper - VI
MPHL04: LAB-COURSE II - C PROGRAMMING

Min. Marks: 33 **Max. Marks: 100**

Course Outcomes

Students will be able to:

CO1	Write Program in C- Language for a given problem.
CO2	Execute and run the program successfully.
CO3	Debug the errors notified during the run.
CO4	Compare and appreciate the software programming.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- II
Paper - VI
MPHL04: LAB-COURSE II - C PROGRAMMING

Min. Marks: 33 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

1 Write a program to convert the temperature from Celsius to Fahrenheit.
2 Write a program to convert the temperature from Fahrenheit to Celsius.
3 Write a program that prints the even numbers from 1 to 100.
4 Write a program that computes and prints a table of factorials for any given number n.
5 Write a program to calculate and print the first n Fibonacci numbers.
6 Write a program to calculate simple interest.
7 Write a program for simple interest of three sets of principal amount, rate and number of years.
8 Write a program to sort numbers in ascending order.
9 Write a program to sort numbers in descending order.
10 Write a program to accept three numerical values and print the biggest number out of this.
11 Write a program to input an integer through key board and then to find out whether it is odd or even number.
12 Write a program to print two numbers.
13 Write a program for solving two simultaneous equations.

REFERENCES:

1. Programming in Ansi C by E- Balagurusamy
2. Let us C by Jayant Kanetkar

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Alumni (member).....	3. Dr. Anita Shukla .....
Prof. from other Dept. of Sc. Faculty	4. Dr. Siteshwari Chandraker .....
Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
	6. Dr. Kusumanjali Deshmukh.....

DEPARTMENT OF PHYSICS
GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG
Approved syllabus for M.Sc. (PHYSICS) Semester III by the members of Board of Studies
for the Session 2024-25

Semester III

The syllabus with the paper combinations is as under

Paper I **MPH301: CONDENSED MATTER PHYSICS**	**Paper II** **MPH302: NUCLEAR & PARTICLE PHYSICS**
Paper III **MPH303: Special Paper-I (ELECTRONICS)**	**Paper IV** **MPH304: Special Paper-II (ELECTRONICS)**
Paper V **MPHL05: Lab Course I - GENERAL**	**Paper VI** **MPHL06: Lab Course II - ELECTRONICS**

Name and Signatures

V.C. Nominee	Departmental members 1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Subject Expert	3. Dr. Anita Shukla .....
Alumni (member).....	4. Dr. Siteshwari Chandraker .....
Prof. from other Dept. of Sc. Faculty	5. Dr. Abhishek Kumar Misra .....
Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

Syllabus and Marking Scheme for M.Sc. (Physics) Semester III
Session 2024-25

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment	
		Max	Min	Max.	Min.
I	MPH301: CONDENSED MATTER PHYSICS	80	16	20	04
II	MPH302: NUCLEAR & PARTICLE PHYSICS	80	16	20	04
III	MPH303: SPECIAL PAPER-I (ELECTRONICS)	80	16	20	04
IV	SPECIAL PAPER-II (ELECTRONICS)	80	16	20	04
V	LAB COURSE I- A (GENERAL)	100	34		
VI	LAB COURSE II- B (ELECTRONICS)	100	34		
	Total	520		80	

04 Theory papers - 320
04 Internal Assessments - 80
02 Practicals - 200
Total Marks - 600

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	6. Dr. Kusumanjali Deshmukh.....

The Scheme of Internal Assessment
Session 2024-25
M.Sc. (Physics) Semester III

Paper No.	Paper Name	Test Marks I	Test Marks II	Home Assignment/ Seminar III	Total
I	**MPH301: CONDENSED MATTER PHYSICS**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
II	**MPH302: NUCLEAR & PARTICLE PHYSICS**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
III	**MPH303: SPECIAL PAPER-I (ELECTRONICS)**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar(20 Marks)
IV	**MPH304: SPECIAL PAPER-II (ELECTRONICS)**	20 Marks	20 Marks	Only one seminar (20 marks) Presentation (10 marks) Viva (10marks)	Average of Best of Test and Home Assignment/ Seminar(20 Marks)

Note: Compulsory submit one hardcopy and softcopy of ppt after presentation.

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Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination have the following main points
The question paper will be of **80 marks**

1. Questions will be asked Unit-wise in each question paper.
2. From each Unit, the questions will be asked as follows:

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:
   i. Two Internal Test in each paper (20 marks).
   ii. Seminar (Power point presentation) in any one of the papers (20 marks).
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar(20 marks).
   iv. Average of marks obtained in best of internal test + seminar in any one paper and marks obtained in best of internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT. V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper - I
MPH301: CONDENSED MATTER PHYSICS

Course Outcomes

This course acts as a bridge between a physicist and a material scientist.
After successful completion of the course, the student would be able to:

CO1	Have basic knowledge of crystal systems and spatial symmetries, - be able to account for how crystalline materials are studied using diffraction, including concepts like reciprocal lattice and Brillouin zones
CO2	Know what phonons are, and be able to perform estimates of their dispersive and thermal properties, be able to calculate thermal and electrical properties in the free-electron model
CO3	Know Bloch's theorem and what energy bands are and know the fundamental principles of semiconductors and explain superconductivity using BCS theory
CO4	Understand basic models of dia, para and ferro magnetism and theories of spin waves, Bloch laws and classify them.

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GOVT. V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper - I
MPH301: CONDENSED MATTER PHYSICS

Min. Marks: 16 **Max. Marks:80**

UNIT-I Crystalline solids, Unit cells and direct lattice, two and three dimensional Bravais lattice, closed packed structures, Interaction of X-rays with matter, absorption of X-rays. Elastic scattering from a perfect lattice. The reciprocal lattice and its applications to diffraction techniques. The Laue, powder and rotating crystal methods, crystal structure factor and Intensity of diffraction maxima.

UNIT-II Classification of defects, Point defects Lattice vacancies, Schottky defect, Frankel defect, Extrinsic vacancies, Colour centres: F-centres. Line defects: Edge dislocation, Screw dislocation, Plane defects: Grain boundaries, stacking fault, The role of dislocations in plastic defermation and crystal growth.

UNIT-III Nearly free electron model, Bloch theorem, Origin of energy gap, Brillouin zones, Distinction between metals, insulators and semiconductors, Direct and indirect band gap semiconductor, equation of motion of electron in an energy band, concept of holes, effective mass, mobility, Construction of Fermi surface, reduced and periodic zone Schemes, Experimental methods for fermi surface study (i) de Haas Von Alfen Effect (ii) Cyclotron Resonance (iii) Magneto resistance Super conductivity, experimental survey, Meissner effect, Energy gap, Isotope effect, London equation, cooper pairs, BCS theory, Type I & Type II Superconductor, DC & AC Josephson Effect.

UNIT-IV Classification of magnetic substances, Langevin's Diamagnetic equation, Quantum theory of paramagnetism & curie law, Weiss theory of ferromagnetism, Heisenberg's exchange interaction, analysis of exchange integral, Ferromagnetic spin waves & magnon dispersion relation, Bloch $T^{3/2}$ law, Ferromagnetic order, structure of ferrites. Anti ferromagnetic ordering, Anti ferromagnetic magnons, Origin of ferromagnetic domains, Anisotropy energy, Bloch wall, exchange energy.

REFERENCES:

1. C.Kittle – Solid state physics.
2. Verma Shrivastava – Crystallogepy
3. Singhal.
4. Dekkar.
5. Saxena Gupta Saxena.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper - II
MPH302: NUCLEAR & PARTICLE PHYSICS

Course Outcomes

After successful completion of the course the student would be able to

CO1	Acquire clear understanding of nuclear interaction, scattering and correlate data to retrieve information about nuclear structure.
CO2	Visualize nuclear models with the help of various experimental evidences.
CO3	Acquire knowledge about nuclear decay processes and build idea about nuclear phenomena.
CO4	Recognize different interactions of elementary particles and classify them based on their characteristics.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper - II
MPH302: NUCLEAR & PARTICLE PHYSICS

Min.Marks: 16 **Max. Marks:80**

UNIT-I **Nuclear Interaction & Nuclear Reaction:** Nucleon-nucleon interaction, Exchange forces, Meson theory of nuclear forces, nucleon-nucleon scattering, Effective range theory, spin dependence of nuclear forces.
Direct and compound nuclear reaction mechanism, close reaction in terms of partial wave amplitudes, compound nucleus, Reciprocity theorem, Breit-Wigner one level formula.

UNIT-II **Nuclear Models :** Liquid drop model, Bohr-Wheeler theory of fission, Experimental evidence for shell effects, shell model, Spin orbit coupling, Magic numbers, angular momentum and parity of nuclear ground states qualitative discussion and estimates of transition rates. Magnetic moments and Schmidt lines, collective model of Bohr and Mottelson.

UNIT-III **Nuclear Decay** : Gamow theory of α-decay, Barrier penetration; Shape of β-spectrum, Parity violation, Fermi theory of β-decay, total decay rate, allowed and forbidden transitions in β-decay; Multipole radiative transitions in nuclei (γ-radiation), Angular momentum and parity selections rules in multipole radiation, Internal conversion, Nuclear isomerism, Mossbauer effect.

UNIT-IV **Elementary Particle Physics** : Types of interactions between elementary particles, Hadrons and Leptons, Symmetry and conservation laws, Strangeness, Hypercharge, CPT invariance; Classification of elementary particles, Basic idea of SU(2) symmetry, SU(3) symmetry and Quark model, Flavour and Colour of Quarks, Gellmann-Nishijima formula, Gell-Mann Okubo Mass Formula, Standard Model.

Name and Signatures

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Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

REFERENCES :

1. Introduction to Nuclear Physics by H.A. Enge
2. Introduction to Elementary Physics by D. Griffith
3. Introductory Nuclear Physics by Kenneth S. Krane
4. Nuclear & Particle Physics by B. R. Martin
5. Fundamentals in Nuclear Physics by J. Basdevant, J. Rich & M. Sipro
6. Atomic and Nuclear Physics by Ghoshal
7. Elements of Nuclear Physics by Pandya & Yadav
8. Nuclear Physics by D. C. Tayal

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper - III
MPH303: Special Paper-I (ELECTRONICS)

Course Outcomes

After successful completion of the course the student would be able to:

CO1	Know and discuss differential amplifier circuits.
CO2	Apply knowledge of OPAMP and analyse its block diagram and different configurations
CO3	Understand and explain Summing Amplifier, Differentiator, Integrator, Clipping Clamping circuits, Multi-vibrators
CO4	Describe and discuss applications of OP-AMP as oscillators in all configurations.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper - III
MPH303: Special Paper-I (ELECTRONICS)

Min. Marks: 16 **Max. Marks: 80**

UNIT-I **DIFFERENTIAL AMPLIFIERS**: Circuit configurations, Dual-Input Balanced-output differential amplifier: DC analysis, AC analysis, Inverting and non-inverting inputs, common-mode rejection ratio. Dual-input unbalanced-output differential amplifier: DC analysis, AC analysis. Single-input, Balanced-output differential amplifier: DC analysis, AC analysis.

Single-input unbalanced-output differential amplifier: DC analysis, AC analysis. FET differential amplifiers, Differential amplifiers with swamping resistors, Constant current bias, current mirror, cascaded differential amplifier stages, cascode or CE-CB configuration.

UNIT-II **OP-AMP :** Block diagram of an op-Amp; Analysis of Typical OP-AMP equivalent circuits schematic symbol open loop OP-AMP configuration. Differential amplifier using OP-AMP, inverting amplifier, non - inverting amplifier. An OP - AMP with negative feedback, closed loop Voltage gain, Difference input Voltage ideally zero, Input resistance with feedback, output resistance with feedback, Band width with feedback. Total output offset Voltage with feedback, Voltage follower.

PRACTICAL OP-AMP- Introduction, Input offset Voltage, Input offset,current. Common mode configuration and CMRR, CMRR as a function of frequency.

Name and Signatures

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UNIT-III **OP-AMP as:** DC & AC Amplifiers, Summing Amplifiers: inverting configuration, Non-inverting configuration, Differential configuration. Scaling Amplifiers: inverting configuration, Non-inverting configuration, Differential configuration. Averaging Amplifiers: inverting configuration, Non-inverting configuration, Differential configuration. Differentiator, Integrator, Clipping and Clamping circuits, Comparators, 555 Timer: 555 as a monostable Multi-vibrators, Monostable multivibrator applications, 555 as an Astable multivibrator, Astable multivibrator applications. Frequency to Voltage and voltage to frequency Converters.

UNIT-IV **APPLICATIONS OF OP-AMP-** As Oscillator, Oscillator Principle, Phase shift Oscillator, wean bridge Oscillator, square wave generator, Triangular wave generator, Active Filters- First order Low Pass Butter worth filters filter design and frequency scaling. Second order low pass butter worth filter- filter design, First order high pass butter worth filter, Second order high pass butter worth filter, higher filters Band pass filters – wide band pass filter narrow band pass filter, band Reject filters- wide band reject filters, narrow band reject filter, All pass filter.

REFERENCES:

1. OP-AMP and linear Integrated Circuits- Ramakant Gayakwad, PHI, New Delhi.
2. Linear Interated Circuit and Application by Godse and Baksi (Technical Publication)

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper - IV
MPH304: Special Paper-II (ELECTRONICS)

Course Outcomes

After successful completion of the course, the student would be able to

CO1	Understand different types of Flip-flops and apply them in shift registers and counters
CO2	Discuss working of Opto eelctronic devices and design digital display units.
CO3	Analyses Principles microwave communication systems.
CO4	Discuss and demonstrate principle and arrangements of radar system.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper - IV
MPH304: Special Paper-II (ELECTRONICS)

Min. Marks: 16 **Max. Marks:80**

UNIT-I **Combinational Logic**: Half and full adders, half and full substractors, binary adders, 8421 adders, 2's compliment adder subtractor, Decoder, Encoder Multiplexer.

Sequential Logic: Latch, Flip-flops: RS Flip-flop, level clocking, Edge triggered Flip Flops, D Flip flops. JK Flip-flops, J.K. master slave Flip-flops, Registers: shift and control shift registers, counters: ripple synchronous & ring counters.

UNIT-II **OPTO ELECTRONICS –** Photo detector, Photo conductor, photo diode LED and LCD display system. Measuring instruments with LED indicators, LED numeric and alphanumeric display units, Digital instruments, Advantages of digital instruments. Digital display method, Digital display units, seven segment display and Accuracy for Digital meters.

UNIT-III **MICROWAVE COMMUNICATION** - Principles of two cavity klystrons & reflux klystrons, principle of operation of magnetron, Traveling wave Tubes (TWT) Gunn Effect, Advantages and disadvantages of microwave communication.

UNIT-IV **RADAR SYSTEMS –** Principle of RADAR, basic arrangement of Radar System, Azimuth & Range measurement, Characteristics of Radar system, Radar Transmitting systems, Radar antennas, Radar receivers.

SATELLITE SYSTEM- Function of a Communication satellite. Geo-stationary and Geo synchronous orbit, satellite and earth station geometry.

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REFERENCES:

1. Handbook of Electronics by Kumar & Gupta
2. Fundamental; of Digital Circuit by A. Anand Kumar
3. Digital Electronics by R.P. Jain
4. Microwave devices and circuits by Samuel Y. liao
5. Microwave & Radar Engineering by M. Kulkarni
6. Satellite Communication by D.C. Agrawal
7. Semiconductor devices phy. & Tech.by S.M.Sze.
8. Introduction to semiconductor device by M.S.Tyagerajan

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper – V
MPHL05: LAB-COURSE I – GENERAL

Course Outcomes

Students are expected to understand working mechanics and factors governing electrical and magnetic properties of material. Students will be able to

CO1 Design and resolve circuits for electronic applications.

CO2 Record data as required by the experimental objectives.

CO3 Analyse recorded data and formulate it to get desired results.

CO4 Interpret results and check for attainment of proposed objective.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper – V
MPHL05: LAB-COURSE I - GENERAL

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

1. Study of Network theorems.
2. Study of LED
3. Study of characteristics of G.M. counter & determination of operating voltage.
4. Numerical, aperture of Optical fibre.
5. Study of clipping and clamping circuits.
6. Determination of Stefen's constant.
7. Study of Hall Effect.
8. Study of bending loses of optical fiber.
9. Attenuation constant of optical fiber.
10. Distinction between actual & Virtual source using laser.
11. Refractive index of glass using laser.
12. Quinke's method.
13. Slit width-using laser.
14. B-H curve & Hystersis loss.
15. Study of thermo-luminescence.
16. Determination of the number of countes at various distences between the radio active Source & the tube
17. Determination of the effect of various obstical at the number of Counts between radio active source & tube.
18. To study the variation of leakage current with change in Temperature.
19. Rydberg Constant.
20. Dielectric constant for liquid.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester- III
Paper – VI
MPHL06: LAB-COURSE II- ELECTRONICS

Course Outcomes

Students will be able to:

CO1 Design and resolve circuits for electronic applications.

CO2 Record data as required by the experimental objectives.

CO3 Analyse recorded data and formulate it to get desired results.

CO4 Interpret results and check for attainment of proposed objective.

Name and Signatures

V.C. Nominee	Departmental members
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester- III
Paper – VI
MPHL06: LAB-COURSE II- ELECTRONICS

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks
Expt : 60 marks
Sessional: 20 marks
Viva: 20 marks

List of Experiments

1. Four-bit adder & subtractor.
2. Up-down carrier using 74193.
3. 4-bit ripple counter.
4. Binary counter using 7490.
5. Half adder & full adder.
6. De Morgan's theorems.
7. Modulation & Demodulation.
8. Study of Active filters
9. Study of seven segment display.
10. Digital to Analog conversion.
11. Study of Multi vibrators.
12. Construction of an IC amplifier.
13. Negative feedback amplifier.
14. Applications of 741 & 74l d

Name and Signatures

V.C. Nominee	Departmental members 1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Subject Expert	3. Dr. Anita Shukla .....
Alumni (member).....	4. Dr. Siteshwari Chandraker .....
Prof. from other Dept. of Sc. Faculty	5. Dr. Abhishek Kumar Misra .....
Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

DEPARTMENT OF PHYSICS
GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG
Approved syllabus for M.Sc. (PHYSICS) Semester IV by the members of Board of Studies
for the Session (2024-25)

Semester IV

The syllabus with the paper combinations is as under

Paper I **MPH401: LASER PHYSICS & APPLICATION OF LASER**	**Paper II** **MPH402: COMPUTATIONAL PHYSICS & FORTRAN PROGRAMMING**
Paper III **MPH403: SPECIAL PAPER- III ELECTRONICS**	**Paper IV** **MPH404 A/ B/C/D/E/F/G: Special Paper- IV Electronics/ Informatics/ Physics of Liquid crystal/ Physics of Nano Material/ Atmospheric Science/ Astronomy and Astrophysics/ Diagram Techniques**
Paper V **MPHL07: PROJECT WORK**	**Paper VI** **MPHL08: LAB COURSE - 8086 MICROPROCESSOR, ARDUINO and EXPEYES**

For PG classes there is provision for Educational tour/ Study tour in renowned institutions.

Name and Signatures

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Prof. from other Dept. of Sc. Faculty	4. Dr. Siteshwari Chandraker .....
Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
	6. Dr. Kusumanjali Deshmukh.....

Scheme for M.Sc. (PHYSICS) Semester IV
Session 2024-25

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment	
		Max	Min	Max.	Min.
I	MPH401: LASER PHYSICS & APPLICATION OF LASER	80	16	20	04
II	MPH402: COMPUTATIONAL PHYSICS & PROGRAMMING	80	16	20	04
III	MPH403: SPECIAL PAPER- III ELECTRONICS	80	16	20	04
IV	MPH404 A/B/C/D/E/F/G: Special Paper- IV Electronics/ Informatics/ Physics of Liquid crystal/ Physics of Nano Material/ Atmospheric Science/ Astronomy and Astrophysics/ Diagram Techniques	80	16	20	04
V	MPHL07: PROJECT WORK	100	34	……	……
VI	MPHL08: LAB COURSE - 8086 MICROPROCESSOR, ARDUINO and EXPEYES	100	34	…….	…….
	Total	520	……	80	……

04 Theory papers	-	320	04 Internal Assessments	-	80
Practical	-	100	Project	-	100
Total Marks	-	600			

Name and Signatures

V.C. Nominee ……	Departmental members
Subject Expert ……	1. H.O.D/ Dr. Jagjeet Kaur Saluja ……
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	6. Dr. Kusumanjali Deshmukh……

The Scheme of Internal Assessment
Session 2024-25 M.Sc. (PHYSICS) Semester IV

Paper No.	Paper Name	Test Marks I	Test Marks II	Home Assignment/Seminar III	Total
I	**MPH401: LASER PHYSICS & APPLICATION OF LASER**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar (20 Marks)
II	**MPH402: COMPUTATIONAL PHYSICS & PROGRAMMING**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar (20 Marks)
III	**MPH403: SPECIAL PAPER- III ELECTRONICS**	20 Marks	20 Marks	20 Marks	Average of Best of Test and Home Assignment/ Seminar (20 Marks)
IV	**MPH404 A/ B/C/D/E/F/G: Special Paper-IV Electronics/Informatics/ Physics of Liquid crystal/ Physics of Nano Material/Atmospheric Science/Astronomy and Astrophysics/ Diagram Techniques**	20 Marks	20 Marks	Only one seminar (20 marks) Presentation (10 marks) Viva (10 marks)	Average of Best of Test and Home Assignment/ Seminar (20 Marks)

Note: Compulsory submits one hardcopy and softcopy of ppt after presentation.

Name and Signatures

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Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination have the following main points
The question paper will be of **80 marks**

1. Questions will be asked Unit-wise in each question paper.
2. From each Unit, the questions will be asked as follows:

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus, there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:
   i. Two Internal Test in each paper (20 marks).
   ii. Seminar (Power point presentation) in any one of the papers (20 marks).
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar) (20 marks).
   iv. Average of marks obtained in best of internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper- I
MPH401: LASER PHYSICS & APPLICATION OF LASER

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	Understand and explain basic Laser principles, Laser behaviour, Properties of laser radiations, Different types of Lasers and Laser applications
CO2	Explain different types Laser used and make a comparison between them.
CO3	Develop familiarity with the vast areas of laser application , especially in spectroscopy
CO4	Explore important connections between theory, experiment, and current applications of laser

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR 2024-25
M.Sc. (Physics) Semester-IV
Paper- I
MPH401: LASER PHYSICS & APPLICATION OF LASER

Min. Marks: 16 **Max. Marks: 80**

UNIT-I

a) Laser Characteristics: Directionality, Intensity, Monochromatic Coherence, Kinetics of optical absorption, line-broadening mechanisms. Population inversion, Laser pumping.

b) Resonators, Vibrational modes of resonators, Number of modes per unit volume, Quality factor Q, Loses inside the cavity, the threshold conditions.

c) Modes of rectangular cavity, Mode selection, Q-switching, mode locking in lasers, General spherical resonator, higher order modes, Hole Burning.

UNIT-II Laser System:

a) Ruby Laser: A three level system, pumping power, spiking.

b) Neodymium Lasers: Nd-YAG Laser, Nd-Glass Laser.

c) Semiconductor Lasers: Central features, Intrinsic, doped and injection Laser, application.

d) Gas Laser: Nitrogen (Vibronic) Lasers, Carbon dioxide laser excimer laser.

UNIT-III

a) Laser spectroscopic Techniques: Raman Scattering, Stimulated Raman effect, Hyper Raman Effect, Photo-acoustic Raman spectroscopy(PARS)

b) Nonlinear interaction of light with matter: Harmonic generation, Phase matching optical mixing, parametric generation of light, self-focusing.

c) Multiphoton processes & applications: Multiquantum photoelectric effect, theory of two photon processes, Doppler free two photon spectroscopy, multiphotons processes, phase conjugate optics (elementary) parametric light oscillators.

UNIT-IV

Applications of Lasers:

Optical Fibre communication: optical fibres numerical aperture, pulse dispersion in step index fibers, modal analysis for a step index fiber, pulse dispersion, multimode fibers, first and second generation fiber optic communication, single mode fiber Gaussian approximation, splice loss, vector modes optical fibre communications laser ranging, A brief description of Laser applications in industry, medicine, astronomy and biology. Application of laser in Isotope separation.

REFERENCES -

1. B.B.Laud -Laser and nonlinear optics.
2. Ghatak & Tyagrajan – Laser and its application.

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GOVT. V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester – IV
Paper –II
MPH402: COMPUTATIONAL PHYSICS & FORTRAN PROGRAMMING

Course Outcomes

After successful completion of the course, the student would be able to:

CO1 Learn and apply different numerical methods such as Newton for physical problems.

CO2 Understand and analyze data by interpolation and curve fitting etc.

CO3 Learn and solve ODE using Picard's Method, Taylor Series expansion

CO4 Apply Newton's forward and backward difference formula , Stirling's formula for numerical differentiation . Use trapezoidal and Simpson's rule for numerical Integration.

Name and Signatures

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GOVT. V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR 2024-25
M.Sc. (Physics) Semester – IV
Paper –II
MPH402: COMPUTATIONAL PHYSICS & FORTRAN PROGRAMMING

Min.Marks: 16 **Max.Marks:80**

UNIT-1 Solution of algebraic and transcendental equation, Newton-Raphson method, bisection method, Regula – Falsi method, Iteration method, rate of convergence of Newton's method when there exist double roots gauss iterative method. Method of Solution using the inverse of the matrix, jacobies method eigen value and eigen vector matrices.

UNIT-2 **Finite difference and Interpolation:** (1) Finite difference forward difference, back ward difference, central difference. (2) Difference of polynomial. (3) Factorial notation, Newton's Interpolation formulae, central difference interpolation formulae. Choice of an interpolation formulae interpolation with unequal intervals.

Curve fitting: Graphical method, principle of least Square, method of least squares and cubic spline Error's in the cubic spline derivatives.

UNIT-3 **Numerical solution of ordinary differential equation (ODE)** : Picard's method, Taylor series method Euler's method . Modified Euler's method .**Runge's Method**: Runge-Kutta method.

Predictor corrector method : Milne's method, Adam-Bashforth's method.

Solution of partial differential equation: function of two or more variables (ii) partial derivates.

UNIT-4 **Numerical differentiation :** Formula for derivatives - Derivatives using Newton's forward difference formula, Derivatives using Newton's backward difference formula, Derivatives using Stirling's central difference formula, Maxima and Minima of a tabulated function.

Numerical Integration: Newton-Cote's Quadrature formula - Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule and Boole's rule.

FORTRAN programmes on least square fit for straight line, solution of ODE by Euler's method, by Runge-Kutta 2nd order and 4th order methods; Trapezoidal rule and Simpson's one-third rule.

.

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Prof. from other Dept. of Sc. Faculty	5. Dr. Abhishek Kumar Misra .....
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REFERENCES:-

1. Introduction method of numerical Analysis by Sastry
2. Numerical Analysis by Rajaraman
3. Numerical Methods by B. S. Grewal
4. Numerical Analysis by Bhupendra Singh
5. Numerical Methods by Dr. P. Kandasamy, Dr. K. Thilagavathy & Dr. K. Gunavathi
6. Calculus of Finite Difference & Numerical Analysis by Gupta & Malik
7. Fortran 77 & Numerical Methods by C. Xavier

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper - III
MPH403: Special Paper- III ELECTRONICS

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	Get familiarized with Amplitude Modulation, its principle and applications
CO2	Present mathematical representation of different modulation techniques.
CO3	Learn and apply sampling theorem for Mathematical representation of of FM and PM signal, inter system comparison (FM & AM) generation of FM direct & indirect method.
CO4	Understand and compare different computer communication systems viz. LAN, WAN and MAN, Wireless network, Network topology, etc.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper - III
MPH403: Special Paper- III ELECTRONICS

Min. Marks: 16 **Max.Marks:80**

UNIT-I **Amplitude modulation:** frequency spectrum of AM, average power, average voltage, modulation index for multiple sign waves modulator, balance modulator, signal side band SSB, generation/method, SSB detection, Transmitter and receivers: Super heterodyne receiver, AM Transmitters.

UNIT-II **Angle modulation:** Mathematical representation of of FM and PM signal, inter system comparison (FM & AM); generation of FM direct & indirect method. Phase Modulation.

UNIT-III **Digital Communication:** Pulse modulation system. Sampling theorem, low pass and band pass signals. Pulse-Amplitude modulation, Channel Band width for a PAM signal, Natural sampling, signal recovery through holding, Differential PCM, Delta modulation.
Digital techniques: ASK, PSK and FSK**,** DPSK QPSK, generation and detection.

UNIT-IV **Computer communication system:** LAN, WAN and MAN, Wireless network, Network topology, OSI and TCP/IP reference model, comparison between them and their criticism, basic idea about ISDN. Time Division Multiple Access (TDMA) Frequency Division Multiple Access (FDMA), ALOHA.

REFERENCES:

1. Principle of communication system Taub & Schilling
2. Communication system-Simon Haykin.
3. Communication system- R.P.Singh & S.D.Sapre.
4. Data Communication and Networking Behrouz A. Forouzan

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV
MPH404A: Special Paper- IV ELECTRONICS

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	Get familiarized with different types of microprocessors.
CO1	To understand advance microprocessor related to different addressing.
CO2	Understand 8088 and 8086 memory interfaces.
CO3	Understand basic I/O interface.

Name and Signatures

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Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV
MPH404A: Special Paper- IV ELECTRONICS

Min. Marks: 16 **Max. Marks:80**

UNIT- I **Architecture of 8086:**

Difference between 8085 and 8086, overview of 8086 Microprocessor Family, Architecture and Pin configuration of 8086.

System Bus structure : Basic 8086 system bus architecture, Minimum mode configuration, maximum mode configuration.

UNIT-II **ADVANCE MICROPROCESSORS**

(i) Real mode and protected mode addressing.
(ii) Data addressing, program memory addressing.
(iii) Data movement Instructions MOV; push/pop.
(iv) Arithmetic and logic instruction (Addition subtraction, multiplication), Basic logic instruction.
(v) Program Control Instructions : Jump Group Controlling, the flow of assembly language program.

UNIT-III **MEMORY INTERFACE:**

(ii) Memory Devices.
(iii) Address decoding
(iv) 8086 (8bit) (16bit) memory Interface
(v) Basic idea about 32 bit and 64 bit memory interface (optional reading)
(vi) Dynamic Ram.

UNIT-IV **BASIC I/O INTERFACE:**

(i) Introduction to I/O interface;
(ii) Basic descriptive idea of Peripheral interface like 8255, 8279 (key board display) 8259(Functional description only)
(iii) Analog to Digital and Digital to Analog Converter.
(iv) Interrupts (Optional Reading Only), Basic interrupt processing (purpose, type, and interrupt instruction only)

REFERENCES:

1. Microprocessor – By B. Ram
2. Microprocessor - By Vibhute
3. Internal Microprocessor Architecture (8086- up to Pentium IV-By Barry R. Bray.
4. Advanced Microprocessors and Peripherals- by K.M. Bhurchandi and A. K. Ray.

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404B: INFORMATICS (DATA COMMUNICATION)

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	Understand and explain switching circuits and propagation delay.
CO2	Learn and Discuss network access control and optical fiber communication
CO3	Explain rate of transmission band width and Hartley Shamon law.
CO4	Apply methods for error correction codes for line control and network overview.

Name and Signatures

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Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404B: INFORMATICS

Unit I

Multiplexing (FDM, TDM), Switching paradigms (circuit, packet and cell switching), Propagation Delay, Clock Synchronization.

Unit II

Network access control (centralized, decentralized, distributed) Overview of Satellite Communication, Broadcast Channel and Optical Fibre Communication Systems. Power and Energy spectra, Distortionless Transmission, Signal distortion over a Channel.

Unit III

Bandwidth and Rate of Transmission, Communication in Noisy channels, Optimum Signal Detection, Channel capacity, Hartley Shannon Law,

Unit IV

Error Correcting Codes. Error control, Line control, Rate control, Repeaters, Concentrators, Regenerators. Link behavior, Pe, Burst error, Optimum picket size, Error control, Elementary coding ideas, ATM as a transport mechanism, An overview of Telecom Network, ISDN.

Text and Reference Books

1. Data communication by Reid and Bartskor
2. Data Networks by Gallager
3. Data Communication by Wiliam Staling
4. Communication networks by Leon -Garcia and Widjaja
5. Introduction to communication systems by S. Haykins
6. Analog and Digital Communication by S. Haykins

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404C: PHYSICS OF LIQUID CRYSTALS

Course Outcomes

After successful completion of the course, the student would be able to:

CO1	Describe the structures, symmetries, order, and phase transitions of the most important liquid crystal phases
CO2	Understand the basic electric, elastic, and optical properties of liquid crystal materials
CO3	Explain the structure and function of liquid crystal displays and devices.
CO4	Discuss questions and problems related to liquid crystal science and applications, and to propose solutions/draw sound conclusions by combining knowledge of liquid crystal physics.

Name and Signatures

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Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404C: PHYSICS OF LIQUID CRYSTALS

Unit I

Classification of Liquid Crystals

Symmetry, structure and classification of liquid Crystals, Polymorphism in thermotropics, Reentrant phenomena in liquid crystals, Blue phases, Polymer liquid crystals, Distribution functions and order parameters, macroscopic and microscopic order parameters. Measurement of order parameters, magnetic resonance, electron spin resonance, Raman Scattering and X- ray diffraction.

Unit II

Theories of Liquid Crystalline Phase Transitions

Nature of phase transitions and critical phenomena in liquid crystals, hard particle, Maier-Saupe and Van der Waals theories for nematic - isotropic and nematic-smectic A transitions; Landau theory: Essential ingradients, application to nematic-isotropic, nematic-smectic A transitions and transitions involving smectic phases.

Unit III

Continuum theory

Curvature elasticity in nematic and smectic A phases, distortions due to magnetic and electric Fields, magnetic Coherence length, Freedericksz transition, field-induced cholesteric-nematic transition.

Dynamical Properties of Nematics The equations of nematodynamics, Laminar flow, molecular motions.

Unit IV

Optical properties of Cholesterics

Optical properties of an ideal helix, agents influencing the pitch, liquid crystal displays.

Ferroelectric Liquid Crystals

The properties of smectic C continuum description, smectic C -smectic A transition, applications.

Discotic Liquid Crystals

Symmetry and structure, mean-field description of discotic liquid crystals, continuum description Lyotropic liquid crystals and biological membrane. Applications of liquid crystals.

Name and Signatures

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Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

Text and Reference Books

1. Chandrasekhar: Liquid Crystals.
2. Vertogen & de Jeu: Thermotropic Liquid Crystals:Fundamentals,
3. de Gennes & Prost: The Physics of Liquid Crystals
4. Introduction to liquid crystals:Physics and Chemistry (1997, Taylor and Francis)
5. Elston & Sambles: The Optics of Thermotropic Liquid Crystal
6. Collyer: Liquid Crystal Polymers: From Structures to Applications
7. Goodby et al.: Ferroelectric Liquid Crystals: Principles, Properties & Applications

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
Alumni (member).....	3. Dr. Anita Shukla .....
Prof. from other Dept. of Sc. Faculty	4. Dr. Siteshwari Chandraker .....
Specialist from Industry.....	5. Dr. Abhishek Kumar Misra .....
	6. Dr. Kusumanjali Deshmukh.....

GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404D: PHYSICS OF NANOMATERIALS

Course Outcomes

After successful completion of the course, the student would be able to:

CO1 Describe nanomaterial structures, their synthesis techniques and develop ideas for newer methods

CO2 Illustrate and present distinguishing features of carbon nanostructures. Analyse its electrical, mechanical and vibrational properties

CO3 Realize effect of compositions of different bulk nanostructures and present its application.

CO4 Present theoretical interpretation of quantum well, quantum dots and wires and apply it for infrared detectors and superconductivity.

Name and Signatures

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Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404D: PHYSICS OF NANOMATERIALS

Unit-I: Nano Materials

Properties of Nano-Particles: Metal Nano-clusters: Magic Numbers, theoretical modelling of nanoparticles, geometric and electronic structure, Reactivity, Fluctuations, magnetic clusters, Bulk to Nano transition. Semiconducting nanoparticles: optical properties, Photo fragmentation, Columbic Explosion. Rare gas and molecular clusters: Inert-Gas Clusters, Superfluid Clusters, Molecular Clusters. Methods of Synthesis: RF Plasma, Chemical Methods, Thermolysis, Pulsed Laser Methods.

UNIT II: Carbon Nanostructures

Carbon Molecules: Nature of Carbon Bonds, New Carbon Structures. Carbon Clusters: Small Carbon Clusters, Discovery of C_{60}, Structure of C_{60} and its Crystal, AIkali-Doped C_{60}, Superconductivity in C_{60}, Larger and Smaller Fullerenes, Other Bucky balls. Carbon Nanotubes: Fabrication, structure, Electrical Properties, Vibrational Properties,Mechanical Properties. Applications of Carbon Nanotubes: Field Emission and Shielding Computers, Fuel Cells, Chemical Sensors, Catalysis, Mechanical Reinforcement.

UNIT III: Bulk Nanostructured Materials

Solid Disordered Nanostructures: Methods of Synthesis, Failure Mechanisms of Conventional Grain-Sized Materials, Mechanical Properties, Nanostructured Multilayers, Electrical Properties, Other Properties, Metal Nano cluster Composite Glasses, Porous Silicon. Nanostructured Crystals: Natural Nano crystals, Computational Prediction of Cluster Lattices, Arrays of Nanoparticles in Zeolites, Crystals of Metal Nanoparticles, Nanoparticle Lattices in Colloidal Suspensions, Photonic Crystals. Nanostructured Ferromagnetism: Basics of Ferromagnetism, Effect of Bulk Nano structuring of Magnetic Properties, Dynamics of Nano magnets, Nano pore Containment of Magnetic Particles, Nano carbon Ferro magnets, Giant and Colossal Magneto resistance, Ferro fluids.

UNIT IV: Quantum Wells, Wires and Dots, Self-Assembly and Catalysis

Preparation of Quantum Nanostructures, Size and Dimensionality Effects: Size Effects, Conduction Electrons and Dimensionality, Fermi Gas and Density of States, Potential Wells, Partial Confinement, Properties Dependent on Density of States. Excitons, Single- Electron Tunneling, Applications: Infrared Detectors, Quantum Dot Lasers. Superconductivity.

Self-Assembly: Process of Self-Assembly, Semiconductor Islands, Monolayers. Catalysis: Nature of Catalysis, Surface Area of Nanoparticles, Porous Materials, Pillared Clays, Colloids.

Nanomachines and Nanodevices: Microelectromechanical Systems (MEMSS), Nanoelectromechanical Systems (NEMSs): Fabrication, Nanodevices and Nanomachines. Molecular and Superamolecular Switches.

TEXT AND REFERENCE BOOKS

1. Nanstructures & Nanomaterials: Synthesis, Properties & Applications : Guozhang Cao.
2. Introduction to Nanotechnology : Charles P. Poole Jr and Franks J. Qwens.
3. Handbook of Analytical instruments : R. S. Khandpur
4. Nano materials: Synthesis properties, characterization and application : A.S Edelstein and Nano R. C. Cammaratra.
5. Nanotechnology : Kohlr, Michael.
6. X-ray diffraction procedures : H. P. Klung and L. E. Alexander
7. The Powder Method IV : Azaroff and M. J. Buerger
8. Elements of X-ray diffraction : B. D. Cullity
9. Differential Thermal Analysis : R.C. Mackenzie
10. Thermal Methods of Analysis : W. W. Wendlandt

Name and Signatures

V.C. Nominee	Departmental members 1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404E ATMOSPHERIC SCIENCE

Course Outcomes

After successful completion of the course, the student would be able to:

CO1 Apply laws of thermodynamics to explain adiabatic processes and heat balance of earth-atmosphere system. Understand circulation theorem, voracity and continuity of energy equations for dynamic meterology.

CO2 Understand and explain monsoon dynamics and numerical methods and atmospheric models.

CO3 Enumerate role of meteorology on atmospheric pollution. Understand and explain working of environmental instrumentation systems.

CO4 Describe radar principle of radar technology, signal processing and its application.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404E ATMOSPHERIC SCIENCE

UNIT I

Physical Meteorology

Atmospheric composition, laws of thermodynamics of the atmosphere. Adiabatic process, Potential temperature. The clausis clapyeron equation, laws of black body radiation, solar and terrestrial radiation, Albedo, Green house effect, Heat balance of earth-atmosphere system.

Dynamic Meteorology

Fundamental forces, non-inertial reference frames and apparent forces, structure of static atmosphere.
Momentum, continuity and energy equations, Thermodynamics of the dry atmosphere, elementary applications of the basic equations.
The circulation theorem, voracity, potential vorticity, vorticity and potential vorticity equations.

UNIT II

Monsoon Dynamics

Wind, temperature and pressure distribution over India in the lower, middle and upper atmosphere during pre, post and mid-monsoon season. Monsoon circulation in the meridonal (¥-2) and zonal (X-Y) planes, energy cycle of monsoon. Dynamics of monsoon depressions and easterly waves. Intra seasonal and interannual variability of monsoon. Quasi-be weekly and 30-60 day oscillations. ENSO and dynamical mechanism for their existence.

Numerical Methods for atmospheric Models

Filtering of sound and gravity waves, filtered forecast equations, basic concepts of quasi- geostrophic and primitive equation models, one level and multi-level models. Basic concepts of initialization and objective analysis for wave equation, advection equation and diffusion equation.

UNIT III

Atmospheric Pollution

Role of meteorology on atmospheric pollution, Atmospheric boundary layer, air stability, local wind structure, Ekman spiral, turbulence boundary layer scaling.

Residence time and reaction rates of pollutants, sulphur compounds, nitrogen compounds, carbon compounds, organic compounds, aerosols, toxic gases and radio active particles trace gases.

Atmospheric Instrumentation Systems

Ground based instruments for the measurement of Temperature, Pressure, Humidity, Wind and Rainfall Rate.
Air borne instruments-Radisonde, Rawinsonde, Rockestsonde-satellite instrumentation (space borne instruments)

UNIT IV

Radar Meteorology

Basic meteorology-radar principles and technology-radar signal processing and display-weather radar-observation of precipitating systems-estimation of precipitation-radar observation of tropical cyclones, use of weather radar in aviation, clear air radars-observation of clear air phenomena-other radar systems and applications.

Text and Reference Books

1. The Atmosphere by Frederick K.Lutgens and Edward J.Tarbuk (for chapter | and V1)
2. Dynamic Meteorology by Holton, J.R. 3" edition, Academic Press N.YI, (1992). The Physics of Monsoons, By
3. RN.Keshvamurthy and M.Shankar Rao, Alied Publishers, 1992 (for chapter 3)
4. 'Numerical Weather Prediction, by G.J. Haltiner and R.-Vilians, John Wiley and sons, 1880 (for chapter 4)
5. Principles of Air pollution meteorology by Tom Lyons and Prilscott, CBS publishers & Distributors (P) Ltd,
6. Radar Meterology by Henry Saugageot

Name and Signatures

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404F: ASTRONOMY AND ASTROPHYSICS-I

Course Outcomes

After successful completion of the course, the student would be able to:

CO1 Appreciate H-R diagram and analyse it for stellar distribution. Explain basic equations relating to stellar interiors.

CO2 Understand and explain formation and evolution of stars

CO3 Describe and classify life cycle of stars and its various state. Also able to decide its end life.

CO4 Discuss and explain solar physics related to its magnetic field, winds and chromosphere

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404F: ASTRONOMY AND ASTROPHYSICS-I

Unit - I Stars-apparent magnitudes, Colour index, Spectral classification, Stellar distances, Absolute magnitude, The H-R diagram of stars.
Stellar interiors: The basic equations of stellar structure, Hydrostatic equilibrium, Thermal equilibrium, Virial Theorem, Energy sources, Energy transport by radiation and convection, Equation of state.

Unit – II Formation and evolution of stars: Inter stellar dust and gas, Formation of protostars, Pre-main sequence evolution, Post main sequence evolution and Evolution on the main sequence for low and high mass stars, Late stages of evolution, Fate of massive stars, Supernovae and its characteristics.

Unit – III End states of stars, degenerate states, White dwarfs, and Chandrasekhar limit, Neutron stars and Pulsars, Black holes.
Binary stars and their classification, close binaries, Roche Lobes, Evolution of semidetached systems: Algols, Cataclysmic variables and X-ray binaries.

Unit – IV Solar Physics: Physical Characteristics of sun, Photosphere: Limb darkening, Granulation, Faculae, Solar Chromosphere and Corona, Prominences, Solar Cycle and Sunspots, Solar Magnetic Fields, Theory of Sunspots, Solar flares, solar wind, Helioseismology.

Observational and Conceptual foundations of Newtonian gravity and General Theory of Relativity (GR), Principle of Equivalence, Metric tensor, Covariant differentiation, Riemann curvature tensor, Geodesics.
Stress- Energy tensor, Einstein's field equations, Schwarzschild metric, Particle trajectories in Schwarzschild space-time, Precession of Perihelion, Gravitational red-shift and bending of light.

Name and Signatures

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Prof. from other Dept. of Sc. Faculty	5. Dr. Abhishek Kumar Misra .....
Specialist from Industry.....	6. Dr. Kusumanjali Deshmukh.....

TEXT AND REFERENCE BOOKS

1. Astrophysics for Physicists, Arnab Rai Choudhuri, Camb. University Press, 2010.
2. Modern Astrophysics, B.W. Carroll and D.A. Ostlie, Addison-Wealey Pub.Co.
3. Introductory Astronomy and Astrophysics, M.Zeilik and S.A. Gregory, 4th edition, Saunders college publishing.
4. Theoretical Astrophysics, vol. - II: Stars and stellar systems, T. Padmanabhan, Cambridge university press.
5. The Physical Universe: An introduction to astronomy, F.Shu, Mill valley: University science books.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
2024-25
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404G: DIAGRAM TECHNIQUES

Course Outcomes

After successful completion of the course, the student would be able to:

CO1 Learn many body problem.

CO2 Understand Time dependent Operators.

CO3 Describe and plot Graphical representation of the expansion.

CO4 Derive Green's equation and it's application.

Name and Signatures

V.C. Nominee	Departmental members
Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
Subject Expert	2. Dr. R. S. Singh .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)
SYLLABUS FOR (2024-25)
M.Sc. (Physics) Semester-IV
Paper-IV (Elective Paper)
MPH404G: DIAGRAM TECHNIQUES

UNIT 1 Formalism of Second Quantization

Quantum mechanical many body problem, boson and fermion systems, Creation and Annihilation operators, Commutation Relations, Vacuum state. The Hamiltonian in terms of creation and annihilation operators and its matrix elements for the simple cases of one- and two-particle systems.

UNIT 2 Time Dependent Operators

Schrodinger, Heisenberg and Interaction picture Time development operator (TDO), its properties and equation of motion, The integral equation for TDO and formal solution by iterative method, Dyson chronological operator, S-matrix expansion, Universality of S-matrix Transition matrix, The adiabatic hypothesis and correspondence with usual perturbation theory.

UNIT 3 Introduction to Graphs

Creation and destruction operator in the interaction picture, Particle and hole operators. Reduction of chronological products. Normal product. Contraction of operators and Wick's theorem. Graphical representation of the expansion. First order graphs, Higher order graphs. The interaction term and ground state energy. Ealuation of the contributions of various graphs to the perturbation series, Linked and unlinked diagrams.

UNIT 4 Introduction to Green's Function

Differential equations and their Green's functions. Examples of time independent Schrodinger equation. Resolvent operators. The single particle Green's function. Physical interpretation. Fourier transform of the Green's functions. Lehmann Representation and Kramer-Kronig relationship. Analytic properties and physical meaning of the poles, Relation between Green's function and the properties of the ground state. Its relation With elementary excitations. Concept of quasi particles.

Text and Reference Books

1. Raimes: Many Electron Theory.
2. Mandi: introduction to Quantum Field Theory.
3. Abrikosov: Quantum Field Theoretical Methods in Statistical Physics.
4. Fretter & Walecha: Quantum Theory of Many-particle Systems.
5. March, Young & Sampantha: The Many Body Problems in Quantum Mechanics.

Name and Signatures

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Subject Expert	1. H.O.D/ Dr. Jagjeet Kaur Saluja .....
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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)

SYLLABUS FOR (2024-25)

M.Sc. (Physics) Semester- IV
Paper - V
MPHL07: PROJECT WORK

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks

Project : 60 marks

Sessional: 20 marks

Viva: 20 marks

A Project work will be allotted to the students of M.Sc. III Sem and it will be submitted in IV Sem. Project may be undertaken in any reputed Institute/ Industry/P.G. departments of University or College.

Evaluation of Project work: The Project report duly, signed by the supervisor under whose guidance the work is completed and the Head of the department or institution where the project is completed, shall be submitted to the Physics department of College. Evaluation of the project will be done by the external examiner.

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GOVT.V.Y.T. P.G. AUTONOMOUS COLLEGE, DURG (C.G.)

SYLLABUS FOR (2024-25)

M.Sc. (Physics) Semester- IV

Paper - VI

MPHL08: LAB-COURSE I - 8086 MICROPROCESSOR, ARDUINO and ExpEYES

Min. Marks: 34 **Max. Marks: 100**

Scheme of Marks:

Max. Marks: 100 marks

Experiment : 60 marks

Sessional: 20 marks

Viva: 20 marks

List of Experiment

(i) 8086 MICROPROCESSOR

1 Write a program to add two 16 bit numbers.
2 Write a program to subtract two 16 bit numbers.
3 Write a program to multiply two 8 bit numbers.
4 Write a program to divide 16 bit number by 8 bit number.

(ii) Arduino Software

1. Experiment to glow the LED.
2. Measurement of the resistance of an unknown resistance.

(iii) ExpEYES Kit

1 Study of the V-I characteristics of diodes.
2 Study of the CE configuration of transistor.
3 Study of the half wave rectifier using PN junction.
4 Study of the full wave rectifier using PN junction.
5 Study of the clipping circuit using PN junction diode.
6 Study of the clamping using PN junction diode.
7 Study of OPAMP as inverting and non-inverting amplifier.
8 Study of logic gates, or other experiments of equal standard.

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