M.Phil Physics (Regular / Part Time)

(With effect from the academic year 2010-2011)

CURRICULUM , SYLLABUS AND SCHEME OF EXAMINATIONS

(Approved and Passed in the academic council held on 28-08-2010)

S. No	Subject Code	Subject	Credits	Duration of University Exam	Marks		Total Marks
					CIA	External Exam	
1	MPH 201	**Paper I** Research Methodology	4	3 hrs	40	60	100
2	MPH 102	**Paper II** Advanced Physics	4	3 hrs	40	60	100
3	MPH103 (A/B/C/D/E/ F/G/H/I/J)	**Paper III**	4	3 hrs	40	60	100
		A. Spectrophysics					
		B. Ultrasonics					
		C. Condensed Matter Physics					
		D. Numerical Methods And Mathematical Physics					
		E. Nano Physics					
		F. Crystal Growth And Characterization					
		G. Ultrasonics And Chemical Physics					
		H. Astro Physics					
		I. Op Amp and its Applications					
		J.Non Linear Dynamics					
4		**Dissertation**	18	-	-	150	200
		Viva		-	-	50	
		Total	30		120	380	500
		TOTAL MARKS	500				
		TOTAL CREDITS	30				

M.Phil (PHYSICS) SYLLABUS

MPH201 – PAPER1 - RESEARCH METHODOLOGY

CREDIT : 4

UNIT – I

Research methods – Identification of the Problem – Determining the mode of attack - Literature survey – Mode of approach of actual investigation – Abstraction of a research paper – Drawing inferences from data - Qualitative and Quantitative analysis

UNIT – II

Internet and its applications – e-journals- Assessing the status of the problem – Results and Conclusions – Presenting a Scientific seminar – Publication of Research paper - Art of writing a Thesis.

UNIT – III

Survey of literature including patents - chemical nomenclature and literature primary sources - secondary sources including reviews. Treatise and monographs, literature searching, Review of work relevant to the chosen problems.

UNIT – IV

Writing a thesis or paper - General formation - page and chapter formation. The use of quotation - footnotes - tables and figures - referencing - appendixes - revising the paper or thesis - editing and evaluating and the final product - proof reading - the final types copy.

UNIT – V

Iterative methods: Newton Raphson iterative method – Secant Method; Interpolation: Newton's forward and backward difference formulae; Differentiation and Integration: Numerical differentiation with interpolation polynomials – Numerical Integration by Trapezoidal and Simpson's rule- Ramberg integration.

Books for Reference

1. Thesis and Assignment Writing – J Anderson, B.H. Dursten and M. Poole, Wiley Eastern (1977).
2. A Hand Book of Methodology of Research – P. Rajammal and P. Devadoss, R.M.M Vidya Press (1976).
3. Computer Oriented Numerical Methods – V. Rajaraman, Prentice Hall of India.
4. Numerical Methods for Scientific and Engineering Computation – MK Jain, SRK Iyengar and RK Jain, Wiley Eastern publn.

M.Phil (PHYSICS) SYLLABUS

MPH102 - PAPER II - ADVANCED PHYSICS

CREDIT: 4

UNIT 1

Solar energy

Energy sources and their availability – Prospects of renewable energy sources. Solar cells; Solar cells for direct conversion of solar energy to electric powers- solar cell parameters – solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells- Polycrystalline silicon solar cells- cadmium sulphide solar cells- Applications of solar energy: Solar water heating- space heating and space cooling- solar photo voltaic- agricultural and industrial process heat- solar distribution- solar pumping – solar furnace- solar cooking – solar green house.

UNIT 2

X-ray diffraction

X-rays- X-ray sources- conventional generators – construction and geometry – rotating anode generators – choice of radiation – Synchrotron radiation – X-ray optics: filters – monochromators – collimators – mirrors – safety. Crystals – Lattice planes – Miller indices – Space lattice – X-ray diffraction reciprocal lattice – relation between direct and reciprocal space – Bragg's law in reciprocal lattice – X-ray powder diffraction method.

UNIT 3

Lasers

Lasers: Basic principles of Lasers – Nd:YAG Laser – He-Ne laser – Semiconductor diode Laser – Dye Laser – Co-Chemical Laser - Tunable Laser - Colour Center Lasers. Applications of Lasers in Medicine and Industry – Communication and Holography.

UNIT 4

Non-Linear Optics

Harmonic generation- Second and higher order harmonics generation- Phase Matching – Optical mixing - Optical parametric oscillations – Multi-photon processing.

UNIT 5

Vibrational spectroscopy

Infrared spectroscopy – Vibrational study of diatomic molecules – IR rotation – Vibrational spectra of gaseous diatomic molecules – simple gaseous polyatomic molecules – Correlations of Infra Red Spectra with Molecular Structure - Instrumentation - Sample handling - quantitative Analysis - Raman Spectroscopy - Theory - Instrumentation - Sample Handling and Analysis – SERS – CARS - FT technique in Raman spectroscopy – Application of vibrational spectroscopy in structural elucidations.

Books for Reference

1. Kreith and Kreider, Principles of solar Engineering, Tata McGraw Hill Publication.
2. A.B. Meinel and A.P. Meinel, Applied Solar Energy.
3. M.P. Agarwal, Solar Energy, S. Chand & co.
4. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Edition.
5. G.D. Rai, Non-Conventional Energy sources, Khauna publications, New Delhi.
6. X-ray Structure Determination (2^{nd} Edition) – Stout and Jensen – John Wiley (1989).
7. Fundamentals of Crystallography - (2^{nd} Edition)- C. Giacovazzo- Oxford press.
8. Structure determination of X-ray Crystallography (2^{nd} Edition)- Ladd and Palmer.
9. William Silfvast, Laser Fundamentals , Cambridge University Press, London (1996).
10. B.B. Laud, Lasers and Non Linear optics –New age international P (Ltd) (2^{nd} Edition), New Delhi (1991).
11. Ajoy Ghatak, Optics -(2^{nd} Edition)- Tata Mcgraw Hill Publications.
12. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill (1972).
13. D.N. Sathyanarayana, Vibrational spectroscopy, New Age international (2004).
14. M. Lakshmanan and S. Rajasekhar, Non Linear Dynamics: Intergrability Chaos and Patterns, Springer Verlag, Berlin (2003).

M.Phil (PHYSICS) SYLLABUS

MPH103A - PAPER III - SPECTROPHYSICS

CREDIT: 4

Unit I

Group theory

Symmetry elements and symmetry operations-molecular point groups-classification of point groups-subgroups-character tables for C_{2v} and C_{3v}-great orthogonality theorem-classification of the normal vibrations.

Unit II

Normal coordinate analysis

Introduction-secular equation- internal coordinates - potential energy matrix-symmetry coordinates-band assignments-potential energy constants-normal coordinate analysis of H_2O molecule- quantum chemical methods.

Unit III

Infrared spectroscopy

Electromagnetic spectrum-basic principles of vibrational spectroscopy-energy levels and spectral transitions-introduction-instrumentation-sampling technique- Infra Red Spectroscopy - Correlations of Infra Red Spectra with Molecular Structure - Instrumentation - Sample handling - quantitative Analysis - FTIR spectroscopy- applications

Unit IV

Raman spectroscopy

Introduction-difference between Raman and infrared spectra-quantum mechanical description of the Raman effect-selection rules- depolarisation ratio-resonance Raman effect-FT Raman- instrumentation- sample handling techniques-applications.

Unit V

UV-Visible spectroscopy

Introduction - Beer's law – chromophores – instrumentation - sampling techniques-applications in pharmaceutical field.

Books for Reference

1. Sathyanarayana D N, *Vibrational Spectroscopy- Theory and Applications,* New Age International Publishers, New Delhi.

2. Chatwal Anand, *Instrumental Methods of Chemical Analysis,* Himalaya Publishing House, New Delhi.

3. Jag Mohan, *Organic Spectroscopy Principles and Applications,* Narosa Publishing House, New Delhi.

4. Colin N Banwell and Elaine M Mccash, *Fundamentals of molecular spectroscopy,* Tata McGraw Hill, New Delhi.

5. Molecular Structure and Spectroscopy, G. Aruldhas,Prentice Hall India, New Delhi.

M.Phil (PHYSICS) SYLLABUS

MPH103B - PAPER III - ULTRASONICS

CREDIT: 4

UNIT 1

Characteristics of ultrasonic waves - Propagation through matter-wave Equation, Characteristics, absorption, reflection and transmission of ultrasonic waves-acoustic impedance and intensity, ultrasonic transducers - piezoelectric, magneto restrictive transducers, electromagnetic transducers.

UNIT 2

Propagation of ultrasonic waves in materials (gases, liquids, solids) - attenuation in solids - general principles.

UNIT 3

Ultrasonic instrumentation - low intensity devices, pulse echo overlap and sing around technique - flaw detection, scanning methods - A, B and C scan techniques.

UNIT 4

Ultrasonic propagation in pure liquids - low intensity methods for characterizing structure and interaction - high intensity waves - cavitations, emulsification and cleaning.

UNIT 5

Techniques for polymer characterization - polymer solutions - blends miscibility studies - ultrasonic damage in polymers - scission and cross-linking effects - study by viscometry.

Books for Reference

1. Ultrasonic methods and applications, by J. Blitz Butter worth Public.& co 1971, (for units 1,2,3,&4)
2. Physical Acoustics, Principles and methods. Ed., by W.P. Manson, Vol. II, Part B 1965 (for unit 5)
3. Polymer Science, a materials science hand book, Vol.2 ed by A.D. Jenkins, 1972, (for Unit 5)
4. Polymer International, Vol. 49, 2000 (for unit 5)

M.Phil (PHYSICS) SYLLABUS
MPH103-C - PAPER – III – CONDENSED MATTER PHYSICS

CREDITS: 4

UNIT – I : Crystal Lattice

Crystal Structures – Atomic Packing factor – Crystal diffraction – Bragg's law – Scattered wave Amplitude – Reciprocal Lattice (sc, bcc, fcc) – Diffraction conditions – Laue equations – Brillouin zone – Structure factor – Atomic form factor – inert gas crystals – Cohesive energy of ionic crystals – Madelung constant – Types of crystal binding (general ideas).

UNIT – II : Lattice Dynamics

Lattice with two atoms per primitive cell – First Brillouin zone – Group and phase velocities – Quantization of lattice vibrations – Phonon momentum – Inelasstic scattering by phonons – Debye's theory of lattice heat capacity - Thermal conductivity – Umkalapp processes.

UNIT – III Theory of Metals and Semiconductors

Free electron gas in three dimensions – Electronic heat capacity – Wiedemann-Franz law – Band theory of metals and semiconductors – Bloch theorem – Kronig-Penney model – Semiconductors – Intrinsic carrier concentration – Temperature dependence – Mobility – Impurity conductivity – Impurity states – Hall effect – Fermi surfaces and construction – Experimental methods in Fermi surface studies – De Hass-van Alphen effect.

UNIT – IV : Magnetism

Diamagnetism – Quantum theory of paramagnetism – Rare earth ion – Hund's rule – Quenching of orbital angular momentum – Adiabatic demagnetization - Quantum theory of ferromagnetism – Curie point – Exchange integral – Heisenberg's interpolation of Weiss field – Ferromagnetic domains – Bloch wall – Spin waves – Quantization – Magnons – Thermal excitation of Magnons – Curie temperature and susceptibility of ferrimagnets – Theory of antiferromagnetism – Neel temperature.

UNIT – V : Superconductivity

Experimental facts: Occurrence – Effect of magnetic fields Meissner effect – Critical field – Critical current Entropy and heat capacity – Energy gap – Microwave and infrared properties – Type I and Type II superconductors.

Theoretical Explanation : Thermodynamics of superr conducting transition – London Equation – Coherence length – Isotope effect – Cooper pairs – BCS theory – Single particle tunneling – Josephson tunneling – DC and AC Josephson effects – High temperature Superconductors – SQUIDS.

BOOKS FOR STUDY:

1. C.Kittel, 1996, Introduction to Solid State Physics, 7th Edition, Wiley, New York.

2. M.Ali Omar, 1974, Elementary Solid State Physics – Principles and Applications, Addison – Wesley.

3. H.P.Myers, 1988 Introductory Solid State Physics, 2nd Edition, Viva Book, New Delhi.

BOOKS FOR REFERENCE :

1. N.W.Aschroft and N.D.Mermin, Solid State Physics, Rhinehart and Winton, New York.

2. J.S.Blakemore, 1974, Solid State Physics, 2nd Edition, Saunderr, Philadelphia.

3. A.J.Dekker, Solid State Physics, Macmillan India, New Delhi.

4. H.M.Rosenburg, 1993, The Solid State, 3rd Edition, Oxford University Press, Oxford.

5. S.O.Pillai, 1997, Solid State Physics, New Age International, New Delhi.

6. S.O.Pillai, 1994, Problems and Solutions in Solid State Physics, New Age International, New Delhi.

7. S.L.Altmann, Band Theory of Metals, Pergamon, Oxford.

8. J.M.Ziman, 1971, Principles of the Theroy of Solids, Cambridge Univerrsity Press, London.

9. C.Ross-Innes and E.H.Rhoderick, 1976, Introduction to Superconductivity, Pergamon, Oxford.

10. M.Tinkham, Introduction to Superconductivity, McGraw-Hill, New York.

11. J.P.Srivastava, 2001, Elements of Solid State Physics, Prentice-Hall of India, New Delhi.

M.Phil (PHYSICS) SYLLABUS

MPH103-D - PAPER – III – NUMERICAL METHODS AND MATHEMATICAL PHYSICS

CREDITS: 4

UNIT – I : Interpolation Curve Fitting

Newton's forward interpolation – Newton's backward interpolation – Lagrange interpolation – Curve fitting – Polynomial least squares fitting.

UNIT – II : Differentiation, Integration and Solution of Differential Equations

Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson one third rule – Simpson three-eight rule – Euler method – Improved Euler method – Modified Euler method – Runge-Kutta second order method – Fourth order Runge-Kutta method.

UNIT – III : Matrices:

Introduction – Inverse of a Matrix – Rank of Matrix – Eigen values and Eigen vectors – Characteristics equation – Cayley Hamilton theorem – Diagonalization.

UNIT – IV : Laplace Transform

Laplace Transform – Properties of Laplace transform – Inverse Laplace transform – Properties of inverse Laplace transform – Convolution theorem – Method of Partial fractions – Solving Differential equations.

UNIT – V : Group Theory

Concept of group-sub groups – Cosets – Conjugate classes – Lagrange's theorem – Isomorphism and Homomorphism – symmetry of C2V, C3V and C4V groups – Reducible and Irreducible Representations – Schur's Lemma's orthogonality theorem – Character table – Applications to symmetry groups and molecular vibrations.

Books for study and Reference:

1. Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi (2003) 3rd Edition.

2. Numerical Methods in Science and Engineering – The National Publishing Co.Madras (2001).

3. Numerical Recipes in C, W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T. Vetterling, (1996).

4. Monte Carlo : Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.

5. P.K. Chattopadhyay, Mathematical Physics (Wiley, Eastern, New Delhi,1990)

6. A.W. Joshi, Elements of Group Theory for Physicists (Wiley Eastern, New Delhi, 1971).

7. F.A. Cotton, Chemical Applications of Group Theory (Wiley Eastern, New Delhi, 1987).

8. Sathyaprakash, Mathematical Physics

9. H.K.Dass – Mathematical Physics

M.Phil (PHYSICS) SYLLABUS
MPH103-E - PAPER – III – NANO PHYSICS

CREDITS: 4

UNIT – I : Introduction to Nanomaterials

Historical perspective of Nanomaterials – Classification of Nanomaterials – Reason for the development of Nanomaterials – Challenges in Nanoscience and Technology – Surface energy – Chemical Potential as a function surface temperature – Electrostatic stabilization – Surface charge density – Electric potential at the proximity of solid surface – Vander walls attraction potential – DLVO theory – Steric stabilization.

UNIT – II : Basic properties of Nanoparticles

Size effect and properties of Nanoparticles – Particle size – Particle shape – Particle density – Melting point, Surface tension, wettability – Specific surface area and pore – Composite structure – Crystal structure – Surface Characteristics – Mechanical property – Electrical properties – Magnetic properties – Optical property of Nanoparticle.

UNIT – III Synthesis and Processing of Nanoparticles

Top-down and Bottom-up approaches – Synthesis of metallic and semiconductor Nanoparticles – Physical and chemical techniques – Ball milling laser ablation – Photo, E-beam, X-ray lithography – Molecular beam epitaxy (MBE) – Inert gas condensation – Physical vapour deposition (PVD) – Plasma arching – Chemical vapour deposition (CVD) – Sol-gel techniques.

UNIT – IV : Fabrication and Characterization of Nanostructured Materials

Zero-D, One-D and Two-D structures: Nanoparticles in dispersed in various matrixes – Nanowires – Nanorods – Different growth techniques – VLS and SLS growth – Sol-gel – PVD, CVD, etc. – Nanotubes – Formation and growth techniques – Carbon Nanotubes – Types and Structures – Nanomanipulation: Nanolithography – Soft lithography – Microprinting – Nanoimprint – Dip-pin lithography.

UNIT – V : Properties and Applications of Nanomaterials

Melting point and lattice constant – Estimation of Particles size – XRD, SEM, AFM and TEM – Quantum size effect – Surface Plasmon resonance – Electrical conductivity – Excitons – Scattering – Quantum transport – Magnetic behaviors of Nanoparticles – Dilute magnetic semiconductor – Super Para magnetism – Application in molecular and nano devices: Nanodots – Molecular recognition – Quantum dot wells – Photonic crystal and Plasmon wave guides – Nano DNA devices – Drug delivery system.

Books for Reference

1. Nano – The essentials, T.Praddetp, Mc Graw Hill Education, Chennai.

2. Nanosacle magterials in chemistry, Kenneth, J.Klabunde, 2001, Wiley & Sons, Inc. Publications.

3. Physics and Chemistry of Metal cluster Components, De Jongh.J, 1994, Kulwer academic Publishers, Dordrecht.

4. Nanosystems, Dexler E, John Wiley, CNY.

5. Nanotechnology, AIP Press, Springer – Verlag, Gregory Timp, Editor, 1999, New York, (ISBN 0 – 387 – 98334 – 1).

6. Nanoscale charterization of surfaces & Interfaces, N.JohnDinardo, Weinheim Cambridge: Wiley – VCH, 2000 2nd Ed.

7. Semiconductors for Micro and Nanotechnology – An introduction for engineers, Jan Korvink & Andreas Greiner, Weinheim Cambridge: Wiley – VCH, 2001.

8. Nanomaterials and machines, W.Kamliu et al John Wiley.

9. Hand book of Nanoscience, Engineering and Technology – The Electrical Engineering hand Book series.

M.Phil (PHYSICS) SYLLABUS

MPH103-F - PAPER – III – CRYSTAL GROWTH AND CHARACTERIZATION

CREDITS: 4

UNIT – I : Crystallization from Solution

Introduction:

Main categories of crystal growth methods – The chemical Physics of Crystal growth – Solid growth techniques – Melt growth techniques – Solution growth methods – Vapour phase growth Choosing a crystal growth methods.

Solution Method:

Basic requirements – Crystallization apparatus – Saluration and seeding – Factors that influence the perfection of the final crystal – Control of crystal morphology.

UNIT – II : Crystal Growth in Gel media

Various methods of gel growth – Growth mechanism – Morphologies of various gel grown crystals.

UNIT – III : Crystal Pulling

Material considerations – Crystal growth – Solid solutions and impurities – Growth control – Special techniques.

UNIT – IV : Structural Characterization of Crystals

Different probes for structure analysis – Principles of X-ray diffraction – Experimental methods in structure analysis – Steps in crystal structure analysis – Structure determination – Structure refinement.

UNIT – V : Crystalline perfection and electrical Characterization

Volume, Area, Line and point defects – Threshold concentration of defects in crystals – Methods of detecting imperfections.

Two probe method to determine dielectric constant, electrical conductivity and thermo electric power.

Books for Study:

1. Crystal Growth Edited by Brain R. Pamplin (2^{nd} Edn. Pergamon Press, Oxford, 1980)

2. Crystal in Gels and Liecegand Rings by Heinz K. Henisch (Cambridge University Press, Cambridge, 1988).

3. Crystal Structure Analysis by C.Mahadevan in Horizons of physics (Vol. II) edited by Narendra Nath and A.W.Joshi. (New Age International Publishers, New Delhi, 1996)

Articles for Study:

1. Crystal Growth in Gel media by *C.Mahadevan* (Bulletin of IAPI, **5(9)**, 1988, 243-245).
2. Crystal Growth in Gel media by *A.R.Patel and A.Venkateswara Rao* (Bulletin of Materials Science, **4(5)**, 1982, 527 – 528).
3. A Versatile setup for determination of Dielectric Constant, Electrical Conductivity and Thermo electric power by *A.T.Seshadri, V.K.Vijayaraghavan and G.Balakrishnan* (Bulletin of IPAT, **10(5)**, 1993, 146 – 148).

M.Phil (PHYSICS) SYLLABUS

MPH103-G - PAPER – III - ULTRASONICS AND CHEMICAL PHYSICS

CREDITS : 4

UNIT – I : Generation and Detection of Ultrasonic waves

Production of Ultrasonic waves – Low and High Frequency waves – Longitudinal and Transverse Modes – Piezoelectric and Magnetosriction Transducers.

Measurement of Ultrasonic velocity and absorption – Progressive wave method – Optical method – Acoustic interferometer – Pulse technique Method.

Unit – II : Propagation of Ultrasonic waves in Liquids and Solids

Adiabatic Compressibility – Intermolecular Free length, Internal Pressure and their excess properties – complex formation – detection of Hydrogen bonding using ultrasonic method.

Velocity and attenuation measurement in solids and liquids – stationary and continuous wave method – Pulse-echo method (Direct and interference technique) – Stress, strain, and displacement relations – Elastic constants – Propagation of elastic waves in ferromagnetic, ferroelectric materials – General consideration regarding NDT flaw detection and thickness gauging.

UNIT – III : Dielectric Studies

Comparison of electric and magnetic susceptibilities – Debey's theory of static permittivity – Onsager's theory of the internal field and permittivity.

Dipole moment – Experimental determination – Application to molecular structure – Determination of dipole moment of molecular complexes – Few and Smith method and Huysken's method.

UNIT – IV : Studies on Hydrogen bonding

Hydrogen bonding – models of hydrogen bonding (electrostatic model, Quantum mechanical models) – Non-bonded interactions – Potential energy curves and symmetrical hydrogen bonds – Proton transfer and ion-pair formation – thermodynamics of hydrogen bonding – equilibrium constant.

UNIT – V : IR and NMR Studies

Infrared – Experimental technique – Application of IR spectra in the study of hydrogen bonding – Determination of equilibrium constant – Nash method – Thermodynamics properties – Dipole moment derivatives – Enhancement of intensity in H-bonding system – NMR experimental technique – Chemical shift – Application to H-bonding studies.

Books for Reference

1. Fundamental of Ultrasonics – Jack Blitz – Butterworths – London.
2. Introduction to chemical Ultrasonics – M.J.Blandamer – Academic Press – London.
3. Ultrasonics – Bemsomcarlin – McGraw Hill.
4. Ultrasonic methods in Solid State Physics – John Truell and others – Academic Press.
5. Physical Acoustics – W.P.Mason – Academic Press.
6. Science and Technology of Ultrasonics – Baldev Raj and Others – Narosa.
7. Dielectric Behavior and Molecular Structure – C.P.Smyth - McGraw Hill.
8. Electric Dipole Moments – J.W.Smith – Butterworth Publications.
9. Hydrogen bond – G.C.Pimental – Freeman, Sanfrancisco.
10. NMR – Andrew and Roberts.
11. Solid State Physics – Gupta Kumar – K.Nath & Co., Meerat.

M.Phil (PHYSICS) SYLLABUS

MPH103-H - PAPER – III - ASTRO PHYSICS

CREDITS: 4

Unit 1: The Sun, Planets and their Satellites:

Surface features of the sun in white and monochromatic light. Internal structure, photosphere, chromosphere and corona. Sun spots and magnetic fields on the sun. Solar activity, solar wind and solar-terrestrial relationship.

Atmospheres and Magnetic fields of Earth, Moon and Planets. Satellites and rings of planets, Results of space probes, Origin of the solar system.

Unit 2 : Interstellar Matter, Galaxies and other Astronomical objects:

Composition and properties, Amount of interstellar matter. Estimate of color excess. Visual absorption, Interstellar reddening law and Polarization.

Galaxies, Types of galaxies – Regular galaxies, irregular galaxies, spiral galaxies. Age of galaxies, collision of galaxies. RR – Lyrae stars, planetary nebulae

Unit 3 : Apparent and Mean Position of stars:

Effects of atmospheric refraction, aberration, parallax, precession, nutation and proper motion on the coordinates of stars. Reduction from apparent to mean places and vice versa.

Unit 4 : H-R Diagram:

Introduction to H-R Diagram, Making an H-R Diagram – R.A and DEC., luminosity, temperature dependence, extending the H-R Diagram to stars, H-R Diagram of brightest stars, Hipparcus satellite data and parallex action.

Unit 5 : IMAGE PROCESSING:

Image processing, analyzing an image, CCD's, various process involving in analyzing a image – tricolor image, 3-d view, inverting the color paletes, isophotes, log scaling. Finding asteroids using blinking. 2 – MASS images.

Books for Reference

1. W.M.Smart: Text book of Spherical Astronomy.

2. A.E.Roy: Orbital Motion.
3. McCusky: Introduction to Celestial Mechanics.
4. K.D.Abhyankar: Astrophysics:Stars and Galaxies.Tata McGraw Hill Publication (Chap.2)
5. G.Abell: Exploration of the Universe.
6. Baidyanath Basu: Introduction to Astrophysics.
7. SDSS Sky survey.

M.Phil (PHYSICS) SYLLABUS

MPH103- I - PAPER – III – OPAMP AND ITS APPLICATIONS

CREDITS: 4

Unit I : Fundamentals Of Opamp

Introduction – The Operational Amplifier – Block Diagram – Schematic Symbol – Ideal OPAMP – PIN identification – Equivalent Circuit of an OPAMP

Unit 2 : Linear Aplications

AC and DC amplifiers – Summing Amplifier – Scaling Amplifier – Averaging Amplifier – Instrumentation Amplifier – Voltage to current converter – Current to Voltage Converter – Integrator – Differentiator – Solving simultaneous equations.

Unit 3 : Noise

Noise properties – Noise dynamics – OPAMP Noise – Low Noise OPAMP

Unit 4 : Oscillators

Oscillator Principle – Oscillator types – Phase Shift Oscillator – Wien bridge Oscillator – Squre wave generator – Triangular wave generator – Saw tooth wave generator- Voltage controlled oscillator.

Unit 5 : Comparators And Convertors

Basic Comparator – Zero crossing detectors – Schmitt trigger – Analog to digital converter – Digital to Analog Converter – Clippers and Clampers – Peak Detector- Sample –Hold Circuit

Reference Books:

1. Op Amps and Linear Integrated Circuits – Ramakant A. Gayakwad
2. Modern Digital Electronics – R. P . Jain
3. Integrated Electronics, Analog and digital circuit and systems – Milman and Halkias
4. Linear Integrated Circuits – Uday A. Bakash, Atul P. Godse and Ajay V. Bhakshi

M.Phil (PHYSICS) SYLLABUS

Paper – III – MPH103 J – NON-LINEAR DYNAMICS

Unit 1 : Introduction to Nonlinear Dynamics

The notion of nonlinearity – Superposition principle and its validity – Linear and nonlinear oscillators – Autonomous and nonautonomous systems – Equilibrium points – Phase space – Classification of equilibrium points – Limit cycle motion – Lorentz equations.

Unit 2 : Bifurcation and Chaos in Dissipative Systems

Some simple bifurcations – The logistic map period doubling phenomenon – Onset of chaos – Bifurcation scenario in Duffing oscillator – Nonlinear electronic circuits : chaos in Chua and MLC circuits.

Unit 3 : Chaos in Conservative Systems

Pointcare cross section – Possible orbits in conservative systems – Henon – Heiles system – Charecterization of regular and chaotic motions : Lyapunov exponents – Numerical computation – Power spectrum and dynamical motion.

Unit 4 : Finite Dimensional Integrable Nonlinear Dynamical Systems

The notion of Intergrability – Completer integrability – How to detect integrability : Painleve analysis – Examples – Symmetries and integrability – Integrals of motion – integrable discrete systems.

Unit 5 : Soliton and Complete integrability

Nonlinear dispersive systems – Cnoidal and solitary waves – The Scott Russel phenomenon and K-dV equation – Fermi – Pasta – Ulam numerical experiment – Numerical experiment of Zabusky and Kruskal – Birth of soliton – Lax pair – Inverse scattering transform method for K-dV equation – Explicit soliton solutions – Bilinearisation method – Applications.

Books for Study and Reference

1. M.Lakshmanan and S.Rajasekar, Nonlinear Dynamics : Intergrability Chaos and Patterns (Springer-Verlag, Berlin, 2003)
2. M.Lakshmanan and K.Murali, Chaos in Nonlinear Oscillators (World Scientific, Singapore, 1996)
3. P.G.Drazin, Nonlinear Systems (Cambridge University Press, Cambridge, 1992)
4. A.J.Lichtenberg and M.A.Lieberman, Regular and Stochastic Motion (Springer-Verlag, Heidelberg, 1992).
5. P.G.Drazin and R.S.Johnson, Solitons : An Introduction (Cambridge University Press, Cambridge, 1989).
6. M.J.Ablowitz and P.A.Clarkson, Solitons : Nonlinear Evolution Equations and Inverse Scattering (Cambridge University Press, Cambridge, 1991)