P.G. PROGRAM M. Sc.Medical Physics

SEM-I

Paper-I: Mathematical methods in Physics, statistics and numerical analysis

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP 101	Core	Mathematical methods in Physics, statistics and numerical analysis	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Numerical Methods and Computer Applications

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Numerical Methods and Computer Applications

SYLLABUS

MSMP101:Mathematical methods in Physics and numerical analysis

Unit-1:

Fundamentals of differential and integral calculus Partial differential equations, Second order partial differential equations – Solution by the method of separation of variables – Boundary and initial value problems – one dimensional wave equation – Heat conduction equation – Laplace's equation. Applications in image reconstruction and evaluation

Unit-2

Vector Analysis: Differentiation of vector functions – Concept of gradient, divergence and curl-Gauss's Divergence Theorem – Green's Theorem – Stokes' Vector Space, linearly dependent and independent vectors – Schmidt's orthogonalisation process – Algebra of matrices – Special matrices – Geometrical significance of matrix operators – Rank of a matrix – Eigen values and eigen vectors – Diagonalisation – Cayley – Hamilton Theorem

Unit-3:

Fourier analysis and Partial Differential Equations: Fourier series – Harmonic analysis – Fourier transforms and properties – convolution theorems – Applications

Numerical methods, Computer applications: Linear Systems of Equations and Eigen Value Problems – Solutions of linear systems of equations by Gauss elimination method – Interactive methods of Jacobi and GaussSeidel-inverse of matrices Eigen value problems in matrices – Solution by power method

Unit-4:

Interpolation and Approximation – Interpolation – Newton's formulae – Forward and backward difference – Lagrange's interpolation – Curve fitting – Principles of least squares – Fitting of polynomials – Straight line, Parabolic and exponential.

Unit-5:

Numerical Differentiation --Numerical integration – Solution of Differential Equations – Trapezoidal rule – Simpson's rule – Numerical solution of ordinary differential equations – Euler's methods – Runge – Kutta methods – Taylor's series methods.

REFERENCES

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P.G. PROGRAM M. Sc. Medical Physics

SEM-I

Paper-II: BASIC ELECTRONICS

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P -	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP 102	DC	BASIC ELECTRONICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of BASIC ELECTRONICS

Course Outcomes:-

1. Student will be able to understand and solve the problems related to BASIC ELECTRONICS

MSMP102-BASIC ELECTRONICS

Unit 1:

Basic Electronic components- Semiconductor devices, diode, transistor, oscillator– Electrical measurements – Galvanometer and its applications, MultiMate, Universal Bridge, VTVM and Cathode ray oscilloscope – Special tubes – Electrometer tubes, Photomultiplier tubes and decatron tubes.

Unit 2:

Basic amplifier principles: Pre amplifier circuits -noise, linear pulse amplifier, pulse shaping, — D.C. amplifier – Power, amplifier – Distortion in amplifiers – Feedback amplifiers – emitter follower – Types of oscillators – Power supplies – Rectifiers, filter circuits Regulated HT and EHT supplies – RF power supplies.

Unit 3:

Trigger circuits:– Multivibrator and univibrator – Discriminator – Scale of two - Scale of ten– Coincidence and anticoincidence circuits – Amplitude analyzer and counting rate meters – Small current electrometers – Principles of Servomechanism and control.

Digital electronics, Logic systems: Logic gates, Flip flops- RS, Clocked RS, D, JK, MSJK and T flip flops

Unit 4:

Amplifiers and Oscillators: – Power amplifier design – class B push-pull amplifier – emitter follower – Darlington pair- operational amplifier characteristics – OPAMP amplifier and its frequency response – Instrumentation amplifier – Differentiating and integrating circuits. Solving differential equation – RC phase shift oscillator.

Unit 5:

LVDT – A.C and D.C Tachometers – Capacitance transducers – Thermistor based thermometers – Strain gauge – Ultrasonic transducers and their electrical equivalent circuits. Principles of filters and their application in instrumentation, Strip chart recorder – Magnetic recording – CRO – Phosphors – LED – LCD Plasma display – Seven segment – dot matrix system – Guest Host effect.

REFERENCES

1. J.D.Ryder, Electronics Fundamentals and Applications, Prentice Hall of India, New Delhi. 1987.
2. W.Cooper, Electronic Instrumentation and Measurement Techniques, Prentice Hall of India. 1970.
3. Sawhney, Electrical and Electronic Measurements and Instrumentation, DhanapatRai and Sons, New Delhi – 1982.
4. Malvino and Leech, Digital Principles and Applications, Tata McGrow Hills (1978)
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P.G. PROGRAM M. Sc. Medical Physics

SEM-I

Paper-III: ELECTRO MAGNETIC THEORY, LASER AND OPTICS

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP 103		ELECTRO MAGNETIC THEORY, LASER AND OPTICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of ELECTRO MAGNETIC THEORY, LASER AND OPTICS

Course Outcomes:-

1. Student will be able to understand and solve the problems related to ELECTRO MAGNETIC THEORY, LASER AND OPTICS

MSMP103-ELECTRO MAGNETIC THEORY, LASER AND OPTICS

Unit 1:
Time varying fields and Maxwell's equations: potential functions, electromagnetic boundary conditions, wave equations and their solutions, time harmonic fields
Plane electromagnetic waves: Plane waves in lossless media, Plane waves in lossy media, group velocity, flow of electromagnetic power and the Poynting vector.

Unit 2:
Theory and applications of transmission lines: Transverse electromagnetic waves along a parallel plate transmission line, general transmission line equations, wave characteristics of finite transmission lines, Transmission line impedance matching.

Unit 3: Wave guides and cavity resonators: General wave behavior along uniform guiding structures, parallel-plate waveguide, rectangular wave-guides, circular wave-guides, dielectric wave guides, cavity resonators.

Unit 4:
Lasers: The Einstein coefficients, Laser rate equations, Three level and four-level systems, Temporal and spatial coherence, Ruby laser, Helium-Neon laser, Four level solid state lasers, Carbon dioxide laser, Dye laser, Semiconductor laser, Harmonic generation and stimulated Raman emission.

Unit 5:
Coherence and correlation, Holography, Propagation of light in a dielectric, Propagation in planar dielectric wave guide, Propagation in optical fibres, Calculation of fibre bandwidth, attenuation in optical fibres, fibre materials and fabrication methods, connectors and couplers

REFERENCES

1 David Griffiths, Introductory electrodynamics - Prentice Hall of India-1989
2. David Cheng , Field and Wave electromagnetics, Addison Wesley
3. K. Thyagarajan and A.K. Ghatak - Lasers - Theory and applications – MacMillan
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5. M.J.N.Sibley - Optical Communications (IInd edition) - MacMillan – 1995
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7. N. Sharma - Fibre Optics in telecommunications - Tata McGraw Hill – 1987

P.G. PROGRAM M. Sc. Medical Physics

SEM-I

Paper-IV: NUCLEAR PHYSICS

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP 104		NUCLEAR PHYSICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of NUCLEAR PHYSICS

Course Outcomes:-

1. Student will be able to understand NUCLEAR PHYSICS

MSMP104-NUCLEAR PHYSICS

Unit 1:

Nuclear Structure: – Isotopes, Stability of nuclei, Binding energy, Nuclear forces. Radioactive decay, decay constant, decay chain, half life, mean life, General properties of alpha, beta and gamma rays – Laws of radioactivity – Decay scheme –Theory of alpha, beta and positron emission – alpha and Beta spectrum – gamma emission - electron capture - internal conversion ,nuclear isomerism, artificial radioactivity, production of isotopes, growth of activity, isotopic sources, neutron sources, fission products, Nuclear reactor

Unit 2:

Basic Quantum Mechanics: - Dual nature of matter, uncertainty principle – Operator formalisms – Eigen function and Eigen values – Expectation values – Schrodinger wave Equation. Rigid rotor – Harmonic oscillators and Hydrogen Atom.Elementary perturbation theory and variation principles – Heitler – London theory of Hydrogen molecule – Scattering theory

Unit 3:

Nuclear reaction: – Compound nucleus – Artificial transmutation – Production of high energy particle with Cyclotrons, Betatron, Proton Synchrotrons and Linear accelerations (LINAC), resonant transformer, Discovery of neutron and artificial radioactivity – Nuclear fission – Fission products – Fissile materials – Criticality – Four factor formula – Diffusion and slowing down of neutrons – Fermi equation – Homogeneous and heterogeneous systems – Various types of nuclear reactors – Nuclear weapons – Fusion and thermo nuclear reactions.

Unit 4:

Interaction of electromagnetic radiation with matter: – Thomson scattering - Photoelectric absorption – Angular distribution of photoelectrons – Compton effect, Compton process – Klein Nishina cross-section – Scattering coefficients – Angular distribution of Compton electrons – Pair production – Annihilation radiation, Angular distribution of pair production electrons – energy momentum conservation, Photo nuclear reactions,– Attenuation – Linear, mass attenuation coefficients- Total absorption coefficients. Absorption and scattering coefficients and cross sections

Unit 5:

Neutron capture Neutron sources, properties, energy classification – Elastic and inelastic scattering coefficients and cross sections– Energy transfer and logarithmic energy decrement – Inelastic scattering, Nuclear reaction, Dependence on E and Z – (n, p), (n, χ), (n, γ) and otherreaction – Neutron activation., Radio- isotope production.

REFERENCES

1. K.S.Krane, "Introductory Nuclear Physics", (John Wiley & Sons)
2. B.L.Cohen – Concepts of Nuclear Physics – Tata McGraw Hill
3. Practical Applications of Radioactivity and Nuclear Radiations, G.C.LowentalandP.L.Airey, Cambridge Universiyt Press, U.K., 2001
4. I Kaplan – Nuclear Physics _ Addison Wesley (1962)
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8. P.M.Mathews and K.Venkatesan - A Text Book of Quantum Mechanics – Tata McGraw Hill

P.G. PROGRAM M. Sc. Medical Physics

SEM –I

Paper-V: PHYSICS PRATICAL

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSMP 105		Physics Practical-I	00	00	00	90	60	0	0	12	6

List of Experiments:

1. Demonstration of MATLAB software.
2. Perform mathematical operations using OPAM as Adder, Subtractor, Divider, Multiplicator.
3. Regulated Power Supply. (Transistorized)
4. Wave shaping circuit, clipping, clamping, differentiating and integrating circuits.
5. R.C. coupled amplifier-frequency response.
6. Emitter follower.
7. FET characteristics and calibration of FET Input voltmeter
8. R.C. phase shifts or Wien Bridge (Transistor) Oscillator.
9. Measurement of Hybrid parameters of transistor.
10. 10. Operational amplifier (OP Amp) as integrator & differentiator
11. 13. Study of Astable, Monostable and BistableMultivibrator.
12. 14. MOSFET characterization and application as an amplifier.