ARUNACHAL UNIVERSITY OF STUDIES

Established by Govt. of Arunachal Pradesh vide Act 9 of 2012, the Arunachal University of Studies Act, 2012 Recognized as per u/s 2(f) of University Grants Commission Act, 1956
NH-52, Namsai, Arunachal Pradesh -792103

MASTER OF SCIENCE (PHYSICS) – FIRST SEMESTER

First Semester			
S. No.	**Name of Subject**	**Credits**	**Total Marks**
1	Classical Mechanics	5	100
2	Quantum Mechanics - I	5	100
3	Electronics Devices	5	100
4	Mathematical Physics	5	100
5	General Laboratory-I	4	100
Total		**24**	

Subject Name: CLASSICAL MECHANICS

Unit 1: Preliminaries; Newtonian mechanics of one and many particle systems; conservation laws, work-energy theorem; open systems (with variable mass).Constraints; their classification; D'Alembert's principle' generalized coordinates.

Unit 2: Lagrange's equations; gyroscopic forces; dissipative systems; Jacobi integral ;gauge invariance; generalized coordinates and momenta; integrals of motion; symmetries of space and time with conservation laws; invariance under Galilean transformations.

Unit 3: Rotating frames; inertial forces; terrestrial and astronomical applications of coriolis force. Central force; definition and characteristics; Two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equation; artificial satellites; Rutherford scattering.

Unit 4: Principle of least action; derivation of equations of motion; variation and end points; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation. Canonical transformation; generating functions; Properties; group property; examples; infinitesimal generators; Poisson bracket; Poisson theorems; angular momentum PBs; small oscillations; normal modes and coordinates.

Recommended Texts:

1. Classical Mechanics, by N C Rana and P S Joag (Tata McGraw-Hili,1991)
2. Classical Mechanics, by H Goldstein(AddisonWesley,1980)
3. Mechanics, by A Sommerfeld (AcademicPress,1952)
4. Introduction to Dynamics, by I Perceival and D Richards(CambridgeUniv.Press.1982).

Subject Name: QUANTUM MECHANICS- I

Unit 1: Why QM? Revision ;Inadequacy of classical mechanics; Schrodinger equation; Continuity equation; Ehrenfest theorem; Admissible wave functions; Stationary states.

Unit 2: One-dimensional problems, wells and barriers; Harmonic oscillator by Schrodinger equation and by operator method.

Unit3: Uncertainty relation of x and p, States with minimum uncertainty product; General formalism of wave mechanics; Commutation relations; Representation of states and dynamical variables; Completeness of eigen-functions; Dirac delta function; bra and ket notation; Matrix representation of an operator; Unitary transformation.

Unit 4: Angular momentum in QM; Central force problem: Solution of Schrodinger equation for spherically symmetric potentials; Hydrogen atom.

Unit 5: Time-independent perturbation theory; Non-degenerate and degenerate cases; Applications such as Stark effect.

Recommended Texts:

1. Quantum Mechanics, LI Schiff,(McGraw-Hili)
2. Quantum Physics, S Gasiorowicz, (Wiley)0
3. Quantum Mechanics, B Craseman and J0 Powell, (Addison Wesley)
4. Quantum Mechanics AP Messiah,
5. Modem Quantum Mechanics JJ Sakurai,
6. Quantum Mechanics, Mathewsand Venkatesan

Subject Name: ELECTRONICS DEVICES

Unit 1: Transistors: JEET, BJT, MOSFET and MESFET: Structure, Working, Derivations of the equations for I-V characteristics under different conditions .High Frequency limits.

Unit 2: Microwave Devices: Tunnel diode, transfer electron devices (Gunn diode) Avalanche Transit time devices, Impatt diodes and parametric devices.

Unit 3: Photonic Devices: Radioactive and non-radioactive transitions. Optical Absorption, Bulk and Thin film Photoconductive devices (LOR), diode photo detectors, solar cell-(open circuit voltage and short circuit current, fill factor).LED (high frequency limit, effect of surface and indirect recombination current, operation of LED), diode laser(conditions for population inversion, inactive region, light confinement factor. Optical gain and threshold current for lasing, Fabry-Perrot Cavity Length for lasing and the separation.

Unit 4: Memory Devices: Static and dynamic random access memories S RAM and D RAM, CMOS and NMOS, non-volatile - NMOS, magnetic, optical and ferroelectric memories, charge coupled devices (CCD).

Unit 5: Other Electronic Devices: Electro-Optic, Magneto-Optic and Acousto-Optic Effects. Material Properties related to get these effects. Important Ferro electric, Liquid Crystal and Polymeric materials for these devices. Piezoelectric, Electro strictive and magneto strictive Effects, Important materials exhibiting these properties and their applications in sensors and actuator devices. Acoustic Delay lines, piezoelectric resonators and filters. High frequency piezoelectric devices-Surface Acoustic Wave Devices.

Recommended Texts:

1. Semiconductor Devices – Physics and Technology, by S M Sze Wiley(1985)
2. Introduction to semiconductor devices, M.S .Tyagi, John Wiley &Sons
3. Measurement, Instrumentation and Experimental Design in Physics and Engineering by M.Sayerand A. Mansingh Prentice Hall, India(2000)
4. Optical electronic by Ajoy Ghatak and K. Thyagarajan Cambridge Univ. Press

Subject Name: MATHEMATICALPHYSICS

Unit 1: Vector Spaces and Matrices

Linear independence: Bases; Dimensionality; Inner product; Linear transformations; Matrices; Inverse; Orthogonal and unitary matrices; Independent elements of a matrix; Eigen values and Eigen vectors; Diagonalization; Complete orthonormal sets of functions.

Unit 2: Differential Equations and Special Functions

Second order linear ODEs with variable coefficients ;Solution by series expansion; Legendre ,Bessel, Hermite and Lagaurre equations; Physical applications ;Generating functions ;recursion relations.

Unit 3: Integral Transforms

Laplace transform; First and second shifting theorems ;Inverse LT by partial fractions;~T of derivative and integral of a function; Fourier series; FS or arbitrary period; Half-wave expansions; Partial sums ;Fourier integral and transforms; FT of delta function

Recommended Texts:

1. Mathematical Methods for Physics ,by G Arfken
2. Matrices and Tensors for Physicists, by A W Joshi
3. Advanced Engineering Mathematics ,by E Kreyszig
4. Special Functions ,by E D Rainville
5. Special Functions, by W W Bell
6. Mathematical Method for Physicists and Engineers ,by K F Reily, M P Hobson and S J Bence
7. Mathematics for Physicists ,by Mary L Boas

Subject Name: GENERAL LABORATORY- I

1. To study dielectric constant using parallel plate capacitor.
2. To determine Planck's Constant using Photo cell.
3. To study the characteristics of PNP and NPN transistor's.
4. To calculate the hysteresis loss by tracing a B-H curve.
5. Measurement of hall coefficient of given semiconductor and estimation of charge carrier concentration.

6. Measurement of resistivity of a semiconductor by four probe method at different temperature.
7. Measurement of wavelength of He-Ne laser light using ruler and diffraction grating.
8. To find the refractive index of different liquid using Refracto-meter.
9. To determine the wavelength of spectral lines using plane transmission grating.
10. To determine the wavelength of sodium light by Newtons ring method.
11. To determine the specific resistance of a given wire using Carrey Foster's bridge.
12. To determine refractive index of a glass slab using a travelling microscope
13. To determine the time period of a Simple pendulum for its different length (l) and acceleration due to gravity.