SCHEME OF EXAMINATION

AND

COURSE OF STUDY

CHOICE BASED CREDIT SYSTEM (CBCS)

M. Sc. (PHYSICS)

(w.e.f. 2015-2016)

DEPARTMENT OF PHYSICS
GURUKUL KANGRI VISHWAVIDYALAYA, HARIDWAR

JULY 2015

GURUKULA KANGRI VISHWAVIDYALAYA, HARIDWAR
M.Sc. PHYSICS SYLLABUS (w. e. f. 2015-16)
(CBCS Pattern)

S. N.	Course/Paper Code	Course/Paper Title	Periods per week		Credit	Evaluation Scheme			Maximum Marks (M.M.)
						Continuous Assessment (CA)		ESE	
			L	P		CT	TA		
M.Sc. I Year									
Semester – I									
1	MPH-C101	Mathematical Physics	4	-	4	20	10	70	100
2	MPH-C102	Classical Mechanics	4	-	4	20	10	70	100
3	MPH-C103	Quantum Mechanics –I	4	-	4	20	10	70	100
4	MPH-C104	Computational Methods & Programming	4	-	4	20	10	70	100
5	MPH-C151	Lab. Course (General Physics Lab.)	-	9	4	15	15	70	100
6	MPH-C152	Lab. Course (Computational Lab.)	-	9	4	15	15	70	100
					26			**TOTAL**	**600**
Semester – II									
1	MPH-C201	E.M. Theory & Electrodynamics	4	-	4	20	10	70	100
2	MPH-C202	Statistical Mechanics	4	-	4	20	10	70	100
3	MPH-C203	Quantum Mechanics –II	4	-	4	20	10	70	100
4	MPH-C204	Electronic Components & Circuits	4	-	4	20	10	70	100
5	MPH-C251	Lab. Course (Gen. Electronics Lab.)	-	9	4	15	15	70	100
6	MPH-C252	Lab. Course (Minor Project/Seminar)	-	9	4	15	15	70	100
					24			**TOTAL**	**600**
M. Sc. II Year									
Semester – III									
1	MPH-C301	Solid State Physics	4	-	4	20	10	70	100
2	MPH-C302	Atomic & Molecular Physics	4	-	4	20	10	70	100
ELECTIVES (TWO THEORY & TWO LAB.)*									
3		ELECTIVE-I	4	-	4	20	10	70	100
4		ELECTIVE-II	4	-	4	20	10	70	100
5		Lab. Course (Elective-I Lab.)	-	9	4	15	15	70	100
6		Lab. Course (Elective-II Lab.)	-	9	4	15	15	70	100
					24			**TOTAL**	**600**
Semester – IV									
1	MPH-C401	Physics of Nuclei & Particles	4	-	4	20	10	70	100
2	MPH-C402	Physics & Vedic Thought	2	-	2	20	10	70	100
ELECTIVES (ONE THEORY & ONE LAB.)*									
3		ELECTIVE-III	4	-	4	20	10	70	100
4		Lab. Course (Elective-III Lab.)	-	9	4	15	15	70	100
ELECTIVES (**Dissertation or Two theory paper one each from Electives IV & V**)									
5		ELECTIVE-IV	4	-	4	20	10	70	100
6		ELECTIVE-V	4	-	4	20	10	70	100
7	MPH-E460	Dissertation	-	-	8	-	-	-	200
					22			**TOTAL**	**600**
		TOTAL CREDITS			**96**			**G. TOTAL**	**2400**

L = Lecture P = Practical CT =Cumulative Test TA =Teacher Assessment
ESE= End Semester Examination

* LIST OF ELCETIVES

Elective – I / II		Elective - III	
Course/ Paper Code	**Course/ Paper Name (02 Theory + 02 Practical)**	**Course/ Paper Code**	**Course/Paper Name (01 Theory + 01 Practical)**
MPH-E303	Digital Electronics & Microprocessor	MPH-E403	Communication Electronics-II
MPH-E304	Communication Electronics-I	MPH-E404	Bio-Effect of Atmospheric Fields
MPH-E305	Fundamental Atmospheric Physics	MPH-E451	Lab. Course (Communication Electronics-II Lab.)
MPH-E306	Advanced Atmospheric Physics	MPH-E452	Lab. Course (Advanced Atmospheric Physics Lab.)
MPH-E351	Lab. Course (Digital Electronics & Microprocessor Lab.)	**ELECTIVE-IV& V (Any two)**	
MPH-E352	Lab. Course (Communication Electronics-I Lab.)	MPH-E411	Physics of Nano Materials
MPH-E353	Lab. Course (Atmospheric Physics-I Lab.)	MPH-E412	Electronic Devices
MPH-E354	Lab. Course (Atmospheric Physics-II Lab.)	MPH-E413	Renewable Energy Sources
		MPH-E414	Optoelectronics and Lasers

DISTRIBUTION OF MARKS FOR PRACTICAL/MINOR PROJECT/ SEMINAR/ DISSERTATION

Distribution of marks for Practical / Dissertation shall be as follows:

Practical Examination		**Minor Project/Seminar**		**Dissertation**	
Experiment/ Programming	**40**	Project/SeminarReport Evaluation	**40**	Report Evaluation	**80**
Viva-voce	**20**	Viva-voce/Presentation	**20**	Viva-voce/Presentation	**60**
Record	**10**	Record	**10**	Seminar (Internal) #	**40**
				Diary (Periodic Assessment)#	**20**
TOTAL	**70**	**TOTAL**	**70**	**TOTAL**	**200**

Note:

1. Marks in the Dissertation shall be awarded jointly by the external and internal examiners after viva-voce examination.
2. # There shall be a seminar on dissertation work of the candidate to be evaluated by a Departmental Committee chaired by H.O.D.
3. #The supervisor will assess the student's work periodically and the marks shall be awarded for diary.

M. Sc. I Year		MPH-C101			Semester-I
		MATHEMATICAL PHYSICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

MATRICES & TENSORS

Orthogonal, Hermitian, Unitary and Normal matrices, Pauli and Dirac matrices, Orthogonality conditions, Tensor analysis: Introduction and definitions (Covariant and contravariant tensors, Addition, Multiplication & rank of tensors, Contraction, Direct product, Quotient rule), Pseudo and dual tensors, Levi-Civita symbol, Metric tensor, Christoffel symbols as derivatives of the metric tensor. **(12 Lectures)**

UNIT-II

COMPLEX VARIABLES

Functions of complex variables, Analytic function, Cauchy integral theorem and Cauchy integral formula, Taylor and Laurent series, Theorem of residues, Contour integrals and evaluation of definite integrals.

(12 Lectures)

UNIT-III

SPECIAL FUNCTIONS

Legendre, Bessel, Hermite, Laguerre equations and their solutions & polynomials, Recurrsion relations, Orthogonality and generating functions, Associated Legendre polynomials. **(12 Lectures)**

UNIT-IV

INTEGRAL TRANSFORMS

First and second order shifting theorems, Fouriers series, Fourier integral, Fourier transformes (FT), Dirac-delta functions and its FT, Laplace transforms (LT), Inverse LT by partial fractions, LT of derivative and integral function . **(12 Lectures)**

UNIT-V

PARTIAL DIFFERENTIAL EQUATION

Laplace equation and its solution in rectangular, cylindrical and spherical co-ordinates; Poisson equation (Green's function solution), Two dimensional wave equation, Vibrating membrane (rectangular and circular).

(12 Lectures)

Text Books / Reference Books

1. Mathematical Physics - B.S. Rajput
2. Mathematical Methods for Physics - G Arfken
3. Mathematical Methods for Physics- G.Arfken
4. Applied Mathematics for Physicists & Engineer- Pipes & Harvil
5. Matrices and Tensors for Physicists- A .W. Joshi
6. Advanced Engineering Mathematics- E. Kreyszig
7. Mathematics for Physicists- Mary L . Boas
8. Special functions - E.D. Rainville
9. Special functions –W. W. Bell
10. Mathematical Methods for Physicists & Engineers- K.F. Reily, MPH Hobson & SJ Bence

M. Sc. I Year		MPH-C102			Semester-I
		CLASSICAL MECHANICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

LAGRANGIAN FORMALISM AND VARIATIONAL PRINCIPLE

Mechanics of a particle and system of particles, Conservation laws, Constraints, Degree of freedom, Generalised coordinates, D'Alembert's principle, Lagrange's equation of motion from D' Alembert's principle, Application of Lagrange's equation of motion to a particle and system of particles,Conservation theorem, Hamilton's variational principle, Euler- Lagrange's differential equation. **(12 Lectures)**

UNIT-II

HAMILTONIAN FORMALISM

Need of Hamiltonian procedure, Legendre's transformation and Hamiltonian equations of motion, Physical significance of Hamiltonian, Cyclic coordinates, Hamiltonian equatons in cylindrical and spherical coordinates and their applications, Application of Hamiltonian equation of motion to a particle and system of particles. **(12 Lectures)**

UNIT-III

LEAST ACTION PRINCIPLE AND CANONICAL TRANSFORMATIONS

The principle of least action (no proof), Canonical or contact transformations, Their advantages and examples, Condition for a transformation to be canonical, Infinitesimal contact transformations (ICT), Poisson's Brackets: Definition and properties, Invariance with respect to canonical transformations, Equation of motion in Poisson Bracket form, Jacobian's identity. **(12 Lectures)**

UNIT- IV

MOTION UNDER CENTRAL FORCES

Equivalent one body problem, General features of central force motion, Study of orbits, Virial Theorem, Kepler's laws of planatery motion, Laplace-Runge-Lenz vector, Unbound motion, Scattering in a central force field, Lagrangian and Hamiltonian formulation of relativistic mechanics. **(12 Lectures)**

UNIT-V

MECHANICS OF RIGID BODIES AND THEORY OF SMALL OSCILLATIONS

Coordinates for rigid body motion, Euler's angles, Angular momentum of a rigid body, Moments and products of inertia, Principal axes transformation, Euler's equation of motion of a rigid body, Stable and unstable equilibriums, Lagrange's equation of motion for small oscillaitons, Normal co-ordinates and normal mode, Frequencies of vibration, Free vibration of linear triatomic molecules. **(12 Lectures)**

Text Books / Reference Books

1. Classical Mechanics- N .C Rana and P.S. Joag (Tata Mcgraw-Hill, 1991)
2. Classical Mechanics- H. Goldstien (Addison Wesley, 1980)
3. Mechanics- A. Sommerfeld (Academic Press, 1952)
4. Introduction to Dynamics- I. Perceival and D. Richards (Canbridge Univ. Press)

M. Sc. I Year		MPH-C103			Semester-I
		QUANTUM MECHANICS – I			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

SCHRÖDINGER WAVE MECHANICS AND APPLICATION

Motion of wave packet, Schrödinger equation, Normalised and orthogonal wave functions, Stationary state solution, Expectation values of dynamical variables, Probability current density, Ehrenfet's theorem, Momentum eigen functions and their applications, Coordinate and momentum representation, Rectangular potential barrier and its applications to α - decay, Particle in 1-D infinite deep potential well. **(12 Lectures)**

UNIT-II

BOUND STATE PROBLEMS

One dimensional and three dimensional harmonic oscillators, One dimensional finite square well, Spherically symmetric systems and potentials, Rigid rotator, Hydrogen atom and its normal state. **(12 Lectures)**

UNIT-III

OPERATORS

Algebra of operators, Linear operators, Eigen function and eigen values of operators, Orthogonal and complete set of eigen function, Dirac, Bra and Ket space, Heisenberg's uncertainty relations derived from operators, Hermitian operator and its properties, Matrix representation of operators, Change of basis functions, Unitary and similarity transformations, Equation of motion. Schrödinger, Heisenberg and interaction pictures.

(12 Lectures)

UNIT-IV

ANGULAR MOMENTUM

Commutation Algebra, Commutation relation between position and momentum, Commutation relation for orbital angular momentum (L), Spin angular momentum (S) and total angular momentum (J), Eigen value spectrum for J^2 and J_z , Matrix elements of J_x, J_y, J_z, Addition of angular momentum. **(12 Lectures)**

UNIT-V

IDENTICAL PARTICLES AND SPIN

Physical meaning of identity, Exchange symmetry of wave functions, Symmetric and antisymmetric wave functions, Pauli's exclusion principle and its connection with statistical mechanics, Collision of identical particles, Spin angular momentum, Effect of spin on energy states of an atom (He-atom), Spin orbit interaction and spin correction, Symmetric and antisymmetric wave functions of hydrogen molecule (H_2).

(12 Lectures)

Text Books / Reference Books

1. Quantum Mechanics - L. I. Schiff (McGraw-Hill)
2. Quantum Mechanics - Merzbacher
3. Quantum mechanics - B. Craseman and J D Powell (Addison Wesley)
4. Quantum Mechanics - Mathews and Venkatesan
5. Quantum Mechanics - A. P Messiah
6. Quantum Mechanics - S. Gasiorowicz (Wiley)
7. Modern Quantum Mechanics - J.J. Sakurai

M. Sc. I Year		MPH-C104			Semester-I
		COMPUTATIONAL METHODS AND PROGRAMMING			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

COMPUTATIONAL METHODS

UNIT-I

SOLUTIONS OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS

Algebraic & transcendental equations,Numerical solution, Method of bisection, Method of false position, Newton-Raphson iteration, Direct iterative method, Convergence. **(12 Lectures)**

UNIT-II

INTERPOLATION & CURVE FITTINGS

Errors in polynomial interpolation, Finite differences, Differences of a polynomial, Newton's formula for interpolation, Central differences, Interpolation formulae- Gauss's, Stirling & Bessel formula- Interpolation with unevenly space points- Lagranges interpolation formula, Errors in Lagranges interpolation formula, Curve fitting - Least square curve fitting, Weighted least square approximation. **(12 Lectures)**

UNIT- III

NUMERCAL DIFFERENTIATION AND INTEGRATION

Numercal differentiation, Errors in numerical differentiation, Cubic spline method, Numerical integration Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule– use of cubicsplines, Newton's cotes integration, Gaussian integration. **(12 Lectures)**

C PROGRAMMING

UNIT- IV

Computer languages, Introduction to algorithm, C character set, Identifiers and key words, Data types, Declarations, Expressions, Statements and symbolic constants, #include, #define, Preparing and running a complete C program; Arithmatic, Relational, Logical, Assignments and conditional operators; Precedence rule, Associative law; If-else, Switch, Break, Continue statements; While, Do-while, For statements, Nested loops; Go to statements; One and two dimensional arrays, Basic concept of pointer. **(12 Lectures)**

UNIT- V

Functions: Defining and accessing, Formal and actual parameters, Function prototypes, Recursion, Storage classes (basic concept); Structures: Defining and processing; Data files: Open, Close, Create, Process.

(12 Lectures)

Text Books / Reference Books

1. Introductory Methods of Numerical Analysis - Sastry
2. Numerical Methods in Engg. & Sciences - Grewal B.S. Khanna Pub. N Delhi
3. Numerical Analysis - Rajaraman
4. Computers Today - Byron D.H. Mc Hill
5. Programming in ANSI C - E. Balaguruswamy, TMH
6. Numerical Method for Scientific & Engg Computation - Jain, Iyengar, Wiley, 1987

M. Sc. I Year	MPH-C151				Semester-I
	Lab Course (GENERAL PHYSICS LAB)				
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMENTS

1. Michelson Interferometer
2. Febry-Perot Interferometer
3. C.D. Spectrometer
4. Verification of Cauchy's relation
5. Ultrasonic interferometer
6. Magnetic Susceptibility
7. B-H Curve
8. Planck's constant
9. Four-Probe method
10. Lande 'g' factor using E.S.R. Spectrometer
11. Hall coefficient
12. Determination of Dielectric Constant
13. Design and study of different Network theorems
14. Determination of Hall Life of 'In'
15. Determination of range of Beta-rays from Ra and Cs
16. X-ray diffraction by Telexometer
17. Determination of Ionization Potential of Lithium
18. Determination of e/m of electron by Zeeman Effect using Febry Perot Etalon
19. (a) Measurement of wave length of He-Ne Laser light using ruler
    (b) Measurement of thickness of thin wire with laser
20. To study Faraday effect using He-Ne Laser
21. (a) To find the conductivity (Dark and Phtoconductivity) of a thin film semicondutor at room temperature, low temperature and high temperature
    (b) To study the photointensity and photospectral variation of photoconductivity of a thin film semiconductor

Note:
1. Students are required to perform atleast **ten** experiments from the above list.
2. In practical examination the student shall be required to perform **one** experiment from the list.
3. Experiment shall carry **40 Marks** and **20 Marks** shall be assigned for viva-voce examination. **10** Marks shall be reserved for practical record.
4. No batch for practical class shall consist of more than **20** students.
5. The number of students in a batch allotted to an examiner for practical examination shall not exceed **12-15** students.
6. Addition/deletion in the above list of **some experiments of similar nature** may be made in accordance with the facilities available with the approval of **H.O.D**.

M. Sc. I Year		MPH-C152			Semester-I
		Lab Course (COMPUTATIONAL LAB)			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF PROGRAMMES

LIST-A NA PROGRAMMING

1. To deduce errors involved in polynomial interpolation
2. Algebraic and transcendental equations using bisection, iterative method of false position
3. To implement Bessel's function, Newtons, Stirling, Lagrange's.
4. Implement numerical differential using trapezoidal, Simpson 3/8 rules
5. Integration by trapezoidal rule and midpoint rule
6. Quadratic interpolation using Newton's forward difference formula
7. To find roots of f(x)=0 using Bisection method
8. To find roots of f(x)=0 using Newton-Raphson method
9. To find roots of f(x)=0 using Secant method
10. To show frequency chart, regression analysis, Linear square fit and Polynomial fit
11. To implement method of least square fitting

LIST-B SOLUTION OF PHYSICS PROBLEMS IN C PROGRAMMING

1. Motion of object that falls freely
2. Motion of projectile in horizontal direction
3. Motion of satellite around a planet
4. Motion of body attached to spring
5. Motion of damped harmonic oscillator
6. Fourier sum of harmonic waves
7. Diffraction in N-slits grating
8. Electric field due to N point charges
9. Motion of a charge particle in a uniform magnetic field
10. Growth of current in LR circuit
11. Oscillations in LCR circuit

Note:
1. Students are required to perform atleast **ten** programmes each from the above lists **A** and **B**.
2. In practical examination the student shall be required to perform **two** programmes one each from the **list A** and **list B**.
3. Programmes shall carry **40** Marks and **20** Marks shall be assigned for viva-voce examination. **10** Marks shall be reserved for record.
4. No batch for practical class shall consist of more than 20 students.
5. The number of students in a batch allotted to an examiner for practical examination shall not exceed 12-15 students.
6. Addition/deletion in the above list of **some experiments of similar nature** may be made in accordance with the facilities available with the approval of H.O.D.

M. Sc. I Year	MPH-C201	Semester-II
	E.M. THEORY & ELECTRODYNAMICS	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

ELECTROSTATICS

Boundry value problems, Conductor and uniqueness theorem, Method of images, Image and induced surface charge, Force and energy, Problem of sphere and charge, Multipole expansion potential- Monopole and dipole terms in detail, Electric fields of a dipole, Dielectrics- deceptive parallel, Force and energy in dielectric system.

(12 Lectures)

UNIT-II

MAGNETOSTATICS AND FIELDS IN MATTER

The divergence and curl of B, Ampere's law, Magnetic vector potential, Boundary conditions and multipole expansion, Magnetisation-Dia, para and ferromagnets, Effect of Magnetic field in atomic orbits, Bound currents and their interpretation, Magnetic field inside matter, Ampere's law in magnetised materials, Linear and nonlinear media.

(12 Lectures)

UNIT-III

ELECTRODYNAMICS

Maxwell's equation and magnetic charge, Equation inside matter, Boundary conditions, Potential formulations, Scalar and vector potentials, Gauge transformations, Coulomb and Lorentz gauge, Lorentz force law in potential form, Energy and momentum, Newton's third law in electrodynamics, Poynting theorem.

(12 Lectures)

UNIT-IV

ELECTROMAGNETIC WAVES

Polarisation, Boundary condition, Reflection and refraction, E.M. waves in nonconducting media, Monochromatic plane wave in vacuum, Energy and momentum of E.M. waves, Reflection and transmission at normal incidence and at oblique incidence, Electromagnetic waves in conductors.

(12 Lectures)

UNIT-V

ELECTROMAGNETIC RADIATION

Dispersion -Frequency dispersion, Frequency dependence of ε, μ and σ in noncondutors. Waveguides: Rectangular and circular waveguides. Coaxial transmission line, Dipole radiation, Retarded potentials, Electric dipole radiation.

(12 Lectures)

Text Books / Reference Books

1. Introduction to Electrodynamics - Griffith D.J
2. Classical Electricity and Magnetism - Panofsky & Phillips
3. lassical Electrodynamics -Bittencourt
4. Electricity & Magnetism - A. Kip, McGraw Hill

M. Sc. I Year		MPH-C202			Semester-II
		STATISTICAL MECHANICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

BASIC PRINCIPLES OF STATISTICAL MECHANICS

Thermodyanamic potentials, Thermodynamic equilibria, Nernst's heat theorem, Chemical potential, Phase space, Ensembles, Density distribution of phase space, Liouville's theorem, Microstate and macrostates, Thermodynamical probability, Most probable distribution, Maxwell-Boltzmann disitribution law, Law of equipartition of energy. **(12 Lectures)**

UNIT-II

METHODS OF ENSEMBLES

Microcanonical ensemble- Perfect gas in microcanonical ensemble, Entropy, Gibbs Paradox, Partition function and its correlation with thermodynamic quantities, Canonical Ensemble- Thermodynamic function and partition functions, Grand canonical ensemble- Thermodynamic function and partition functions, Theory of imperfect gases, Equation of state and virial co-efficients. **(12 Lectures)**

UNIT-III

THEORY OF IDEAL GAS

The ideal quantum gas, Bose-Einstein statistics, Fermi-Dirac statistics and Maxwell-Boltzmann statistics, Evaluation of constants α and β and their thermodynamic interpretation, Black body radiation and Planck's radiation, Grand canonical ensemble and the quantum statistics. **(12 Lectures)**

UNIT-IV

IDEAL B/E GAS

Energy and pressure of a gas, Gas degeneracy, Bose-Einstein condensation, Thermal properties of B/E gas, Liquid He, Landau's theory of liquid He-II, Feyman's theory of liquid He-II. **(12 Lectures)**

UNIT-V

IDEAL FERMI GAS

Energy and pressure of a gas, Weakly degenerate and strongly degenerate, Thermodynamic functions of degenerate F/D gas, Electron gas, Pauli theory of paramagnetism and Landau diamagnetism, White Dwarfs , Neutron stars. **(12 Lectures)**

Text Books / Reference Books

1. Statistical Mechanics – R. K. Pathria
2. Statistical Mechanics – K. Huang
3. Statistical Physics - E.S. R. Gopal
4. Theoretical Chemistry - Glasstone
5. Statistical Mechanics - S.K. Sinha
6. Statistical and Thermal Physics- F. Reif
7. Statistical Mechanics - Landau & Lifshitz
8. Introduction to Statistical Physics – Pointon

M. Sc. I Year		MPH-C203			Semester-II
		QUANTUM MECHANICS – II			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

STATIONARY STATE PERTURBATION THEORY

Non-degenerate case, First order and second order stationary perturbation theory, Degenerate case, Zeeman effect (without electron spin), First order Stark effect in H-Atom, The Variation method and its application to ground state of He and Vander-Waals interaction, WKB approximation, Connection formula for barrier penetration, Application of WKB method to theory of α decay. **(12 Lectures)**

UNIT-II

TIME DEPENDENT PERTURBATION THEORY AND SEMICLASSICAL THEORY OF RADIATION

The time dependent perturbation theory, Transition probaility, FG rule, Harmonic perturbation, Adiabatic and sudden approximation, Radiation theory- Interation of radiation with atom, Electron dipole transition and forbidden transition, Classical radiation field, Asymptotic form of radiated energy, Dipole radiation, Planck distribution formula, Application of radiation theory-selection rule for a single particle. **(12 Lectures)**

UNIT-III

SCATTERING THEORY

Laboratory and C.M. frames, Scattering cross section, Wave function for a particle in spherical polar coordinates, Expansion of plane wave in spherical harmonic, Scattering by spherically symeteric potentials (partial wave analysis), Scattering by an attractive potential well, Scattering by a Coulomb field- Rutherford formula, Condition for validity of Born Approximation, Application of Born approximation : (a) Scattering by a square well potential (b) Scattering by a screened Coloumb field. **(12 Lectures)**

UNIT-IV

RELATIVISTIC QUANTUM MECHANICS

The Klien-Gordon equation, Dirac relativistic equation and its covariant form, Dirac free particle solution (Plane wave solution), Probability density and current density, Review of electromegnetic potentials, Dirac equation for particle in E.M. field, Magnetic moment of electron, Existance of electron spin, Spin-orbit coupling, Solution of Dirac's equation for a central field (H-atom), Energy eigen values, Negative energy state and concept of hole. **(12 Lectures)**

UNIT-V

QUANTISATION OF FIELDS

Classical and quantum field equations: Co-ordinates of the field, Time derivative, Classical Lagrangian and Hamiltonian equations, Quantum field equations.

Second quantisation, Quantisation of non-relativistic Schrödinger equation, Creation, Annihilation and number operators, Anticommutation relations, Equation of motion.

Electromagnetic field in vacuum: Commutation relation for E and H, Plane wave representation, Quantised field theory, Quantised field momemtum, Commutation relations at different times. **(12 Lectures)**

Text Books / Reference Books

1. Quantum Mechanics - L. I. Schiff (McGraw-Hill)
2. Quantum mechanics - B .Craseman and J .D .Powell (Addison Wesley)
3. Quantum Mechanics - Mathews and Venkatesan
4. Principles of Quantum Mechanics - I.S. Tyagi (Pearson)
5. Modern Quantum Mechanics - J.J. Sakurai
6. Introduction to Quantum Field Theory, - Paul Roman (John Wiley)
7. Quantum Fields - N.N. Bigollubov & D.V. Shrikov
8. Introduction to Quantum Fiels Theory- Paul Roman

M. Sc. I Year		MPH-C204			Semester-II
		ELECTRONIC COMPONENTS & CIRCUITS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

REVIEW

Network & network theorems, Diode circuits-Rectifiers & smoothing circuits, Voltage multipliers, Limiters & clampers, Photodiode and LED, Zener diode, Varacter diode and tunnel diode, Transistor fundamentals, Transistor biasing, CE and CC amplifier and their small signal equivalanet circuits. **(12 Lectures)**

UNIT-II

FIELD EFFECT TRNASISTER (FET) AND FREQUENCY EFFECTS

FET and MOSFET device chracteristics, FET biasing, FET amplifier, Lead and lag networks, Miller's theorem, High frequency FET and BJT analysis, Bode frequency response plots, Amplifier frequency response. **(12 Lectures)**

UNIT-III

OP-AMP THEORY WITH NEGATIVE FEED BACK

The differrential amplifier, DC and AC analysis of a differential amplifier, CMMR, The OP-AMP, OP-AMP DC offset characteristics, Freuqncy response, Slew rate and power bandwidth, Types of negative feedback: Non–inverting voltage feed back, Effect on input and output impedences, Non–inverting current feedback, Inverting voltage and current feed back, Band width, Closed loop gain and BW. **(12 Lectures)**

UNIT-IV

OP-AMP CIRCUITS

Inverting amplifier, Non-inverting amplifier, Summing amplifier, Active filters, Comparators, The Schmitt trigger, Integrator, Differentiator, Waveform conversion, Waveform generator, Current to voltage and voltage to current converters, Low pass, band pass and band reject filters, Brief study of timer 555. **(12 Lectures)**

UNIT-V

THE OSCILLATORS, VOLTAGE REGULATORS AND THYRISTORS

The positive feedback and oscillations, Wein bridge oscillator, RC and LC oscillators, The unwanted oscillations and stability, Multivibrators.

Zener diode regulators, transistor series voltage regulators, Negative feedback voltage regulators, Transistor shunt voltage regulator, The SCR and its applications, UJT and its applications. **(12 Lectures)**

Text Books / Reference Books

1. Solid State Electronics - Ben G. Streetman, PHI
2. Semiconductor Devices-Physics and Technology- S. M .Sze Wiley (1985)
3. Introduction to Semiconductor devices - M.S. Tyagi, John Wiley & Sons
4. Electronic Devices & Circuits- G.K. Mithal
5. Electronic Principles (3/e)- A.P. Malvino, TMH
6. Op-Amps & Linear integrated circuits - Ramakanth A. Gayakwad, PHI, Second Edition, 1991.

M. Sc. I Year	MPH-C251	Semester-II
	Lab Course (ELECTRONIC CIRCUITS)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMENTS

1. (a) Design and study of low voltage regulated power supply and measure its regulation characteristics
   (b) Design and study of IC 723 and 3 terminal IC regulator based power supply
   (c) Study of 5 V/2 amp. regulated power supply using 3 Pin regulator and series pass transistor
2. Design and study of a CE transistor amplifier and study its frequency response, Input and output impedance
3. Design and study of a CC transistor amplifier and estimate its input, output impedances and frequency response
4. Design a two stage RC coupled BJT amplifier with and without feed back and study frequency response for two different gains
5. Design and study of junction diode limiter & clamper
6. Study of FET characteristics, Load line, Calculation of I_{Dss} and pinch off voltage
7. Study of MOSFET characteristics, Load line, Calculation of I_{Dss} and pinch off voltage
8. Design and study of FET & MOSFET amplifier
9. Study and construction of a Push-Pull amplifier
10. Study and draw V-I characteristics of SCR, its design and application circuit using SCR
11. Design and study of UJT relaxation oscillator. To study wave form generation and storage oscilloscope
12. To study frequency, Voltage, Temperature measurements
13. Study of pin connection and biasing of various linear IC's and timer 555
14. Study of real OP-AMP; The maximum slew rate, Input offsets, Frequency compensation
15. Design and study of OP-AMP as inverting, Non-inverting and summing amplifier
16. Design and study of OP-AMP as subtracter, integrator and differentiator
17. Design and study of OP-AMP as Schmitt trigger and measure its hysteresis characteristics
18. Design and study of astable, monostable and bistable multivibrator using OP-AMP
19. Design and study of phase shift oscillator using OP-AMP
20. Design and study of a Wein bridge oscillator using OP-AMP
21. Study of IC timer 555 as;
    (a) Astable multivibrator (b) A monostable multivibrator (c) Time delay
22. Design and study of high pass, low pass, band pass and band reject filters using OP-AMP
23. Design and test a Logarithmic amplifier
24. Study of function generator using OP-AMP
25. Study of a instrumentation amplifier using OP-AMP

Note:
1. Students are required to perform **ten** experiments from each list.
2. In practical examination the student shall be required to perform **one** experiment. from each list.
3. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics.

M. Sc. II Year		MPH-C301			Semester-III
		SOLID STATE PHYSICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

CRYSTAL STRUCTURE AND LATTICE VIBRATIONS

Introduction to crystal structure, Ionic bonding, Evaluation of Madelung constant, Covalent crystals, Exchange energy calculation, Molecular bonding and Vander-Waals interaction.

Vibration of one dimentional solid, The linear diatomic lattice, Acoustic and optical modes of vibrations, Phonon, Momentum of phonon, Einstein & Debye models and T^3 Law. **(12 Lectures)**

UNIT-II

DEFECTS IN CRYSTALS AND FREE ELECTRON THEORY

Point defects, Line defects and planer faults, The role of dislocations in plastic deformation and crystal growth, X-ray and electron microscopy techniques for observation of imperfections in crystals.

Energy levels and density of orbits (in one dimension), Fermi-Dirac distribution, Free electron gas in three dimension, Electrical conductivity and effect of impurities, Thermal conductivity of free electron gas, Wiedemann -Franz law. **(12 Lectures)**

UNIT-III

ENERGY BANDS IN SOLIDS AND SEMICONDUCTOR THEORY

Wave function in a periodic lattice and Bloch theorem, Kroning Penny model, The nearly free electron approximation, The tight binding approximations, Number of orbitals in a band, Classifying material as semicondutor and band gap, Intrinsic and extrinsic semiconductor, Mobility, Drift velocity and conductivity of intrinsic semiconductors, Carrier concentration in semiconductors, Impurity semiconductors and thermal ionization of impurites, Impurity states and band model. **(12 Lectures)**

UNIT-IV

TRANSPORT PROPERTIES AND MAGNETIC RESONANCE

Boltzmann transport equation, Sommerfeld theory of electrical conductivity, Relaxation time, Hall effect, Experimental determination of Hall coefficient, Residual resistivity, Temperature dependent resistivity, Principle of magnetic resonance, Nuclear magnetic resonance, Electron spin resonannce, Resonance, Flourescence, Theory of Mössbauer effect, Isomer shift, Quadrupole interaction, magnetic hyperfine interaction. **(12 Lectures)**

UNIT-V

SUPERCONDUCTIVITY AND FERROMAGNETISM

The BCS theory, Transition temperature, Meissner effect, Critical field, Type I and type II superconducting materials, Cooper pairs, Joesphson tunneling, Superconductivity at high temperatures (elementary).

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Spin waves and magnons, Curie-Weiss law for susceptibility. **(12 Lectures)**

Text Books /Reference Books

1. Solid State Physics – C.Kittel
2. Solid State Physics - A.J. Dekker
3. Cryatallography for Solid State Physics- Verma & Srivastava

4. Introduction to Solids - Azaroff
5. Elementary Solid State Physics - Omar
6. Solid State Physics : Aschroft & Mermin
7. Principle of Condensed Matter Physics - Chaikim & Lubensky
8. Introduction to Solid State Physics-Paterson

M. Sc. II Year		MPH-C302			Semester-III
		ATOMIC & MOLECULAR PHYSICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

SPECTRA OF ALKALI & ALKALINE ELEMENTS AND X-RAY SPECTRA

Quantum states of an electron atoms, Atomic orbitals, Pauli's principle, Different series in alkali spectra, Term values and quantum defect, Ritz combination principle, Penetrating and non-penetrating orbits, Spin orbit interaction, Spectra of alkali and alkaline elements, Energy state of helium atom, Spectra of helium and mercury, Characteristics of X-ray spectra, Fine structure of X-ray levels, Spin relativity doublets, Flourescence yield and Auger effect. **(12 Lectures)**

UNIT-II

COMPLEX SPECTRA

Hamiltonian of complex spectra atom, L-S and J-J coupling, Term values in equivalent and non-equivalent electron systems, Hunde's rule, Lande interval rule, Energy level diagrams and selection rules in complex spectra, Regularities in complex spectra, Fine and Hyperfine structure of spectral lines, Zeeman effect, Paschan -Back effect and Stark effect. **(12 Lectures)**

UNIT-III

MOLECULAR BINDING AND ROTATION -VIBRATION SPECTRA

Molecular orbital method, The hydrogen melecule ion, Van der-Waals forces for H-atom, Born and Oppenheimer approximation, Rotational spectra of linear and diatomic molecules, Vibrating diatomic molecule, Molecule as anharmonic oscillator, Fine structure of vibration-rotation bands, Vibrational spectra of YX_2 type molecules, Isotope effects in vibrational bands. **(12 Lectures)**

UNIT-IV

ELECTRONIC AND RAMAN SPECTRA

Frank-Condon principle, Vibrational coarse structure, Rotational fine structure of electronic vibration transition, Raman spectra : Classical and quantum theory of Raman effect, Rotational Raman effect , Structure determination from Raman and IR spectroscopy. **(12 Lectures)**

UNIT-V

LASERS

Spontaneous and stimulated emission, Temporal and spatial coherences, Pumping process, Types of Laser:Solid state Laser (Ruby), Gas Lasers (Helium-Neon and Carbon dioxide) and Semiconductor laser (Ga-As), Population inversion, Properties of Laser beams, Laser Applications : Distance measurement, Laser interferometery, Holography. **(12 Lectures)**

Text Books / Reference Books

1. Introduction to Atomic spectra- H.E. White
2. Fundamentals of molecular spectroscopy - C. B.Banwell
3. Molecular spectroscopy - J.M. Brown
4. Introduction to Molecular Spectroscopy - G.M. Barrow
5. Spectra of atoms and Molecules- Jeanne L. McWale
6. Lasers- B.B. Laud
7. Principles of Lasers- O. Svelto

M. Sc. II Year	MPH-E303	Semester-III
ELECTIVE PAPER- I	DIGITAL ELECTRONICS & MICROPROCESSOR	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

NUMBER SYSTEM AND LOGIC CIRCUITS

Number systems - Decimal, Binary, Octal, Hexa decimal and their interconversions, The ASCII code, EXCESS-3 code, Gray code and BCD code, Binary addition and subtraction, 2's complements arithmatic, Half adder and full adder, Binary multiplication and division,Transistor as a switch, OR, AND, NOT and NAND logic gates, Boolean algebra: Boolean laws and theorem, Demorgan's theorem, Logic families : RTL, DTL, TTL, ECL, Sum of product and product of sum methods, K-Map; pairs, quads and octets, K-map simplification, Min-term and max- term analysis. **(12 Lectures)**

UNIT-II

DATA PROCESSING CIRCUITS AND FLIP FLOP

Multiplexer and demultiplexer, Decoder, BCD to decimal decoders, Encoders, Parity generators, Checker, Seven segment display, RS, JK, M/S JK, T & D clocked and edge triggered flip-flop and their timing diagrams. **(12 Lectures)**

UNIT-III

REGISTERS AND COUNTERS

Buffer register, Shift register, Controlled shift register, Ripple counter, Frequency counters, Ring counters, Up and down counters, Electronic counters : Counting unit, Gate generator, Universal counter and its modes of operation. **(12 Lectures)**

UNIT-IV

D/A & A/D CONVERSION AND SEMICONDUTOR MEMORIES

A/D converters: Successive approximation A/D converters, Voltage to time A/D converter, Voltage to frequancy A/D converters and dual-slope integrator A/D converters, D/A conversion techniques, Digital voltmeter, Accuracy and consideration, Memory addressing, ROMS, RAMS, DRAMS. **(12 Lectures)**

UNIT-V

8085 MICROPROCESSOR: ARCHITECTURE & OPERATIONS

Microprocessor architecture and its operations, Memory, Input/output (I/O), The 8085 MPU, Instructions classification, instruction format, How to write and execute a simple programme, Instruction timings and operation status, Data transfer (copy) Instructions, Arithmetic operations,Logic operations, Branch operations, Writing assembly language programs, Debugging a program. **(12 Lectures)**

Text Books / Reference Books

1. Digital Principles and Application- A.P. Malvino and Donald P. Leach , TMH, New Delhi
2. Digital Design - M. Morris Mano, PHI, 1998
3. Microprocessor Architecture, Programming and Applications with8085/8086 by Ramesh S. Gaonkar, Wiley-Eastern Ltd., 1987
4. Microprocesor and Interfacing ,Programmkimg and Hardware -Douglas V. Hall, second edition, Mcgraw Hill International Edition,1992.

M. Sc. II Year	MPH-E304	Semester-III
ELECTIVE PAPER- II	COMMUNICATION ELECTRONICS-I	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

AMPLITUDE MODULATION

Communication systems, Modulation, Bandwidth requirements, Noise: External noise, Internal noise, Noise calculation, Noise figure, Amplitude modulation: Theory, Generation of AM, Basic requirement, Modulated transistor amplifiers, Single side band (SSB) techniques: Evolution of SSB, Suppression of carrier and unwanted side band, Demodulation: Envelop detection, Product detector. **(12 Lectures)**

UNIT-II

ANGLE MODULATION

Theory of frequency and phase modulation- Mathematical representation of FM, Frequency spectrum of FM wave, Phase modulation, Intersystem comparisons, Noise and frequency modulation- Effects of noise on carrier, Pre-emphasis de-emphasis, Comparison of wide band and narrow band FM, Stereo Phonic FM multiplex system, Generation of FM- FM methods, Direct methods, AFC. **(12 Lectures)**

UNIT-III

TRANSMISSION LINES, RADIATION AND PROPAGATION

Fundamentals of transmission lines, Characteristics impedence, Losses, Standing waves, Reactance properties of transmission lines, The Smith chart and its applications,

Ground (surface) waves, Sky wave propagation- The ionosphere, Space waves, Tropospheric scatter propagation, Extraterrestrial communications. **(12 Lectures)**

UNIT-IV

ANTENNAS

The elementary doublet, Wire radiator in space, Antenna gain and effective radiated power, Antenna resistance, Bandwidth, Beamwidth and polarisation, Ungrounded antennas, Grounded antennas, Grounding systems, Effects of antenna height, Antenna coupling at medium frequency, Directional antennas- dipole arrays, Folded dipole and applications, The Yagi antenna. **(12 Lectures)**

UNIT-V

RADIO RECEIVERS

Receiver types- TRF receiver, Superhetrodyne receiver, AM receiver- RF section and characteristic, Frequency changing and tracking, intermediate frequency and IF amplifiers, AGC, Extension of superhetrodyne principle, FM receivers- comparison with AM receiver, Amplitude limiting, Basic FM demodulators. **(12 Lectures)**

Text Books / Reference Books

1. Principles of communication systems - Taub and Schilling, TMH, 1994
2. Electronic Communication System - G. Keneddy
3. Communication systems, Third Edition -Simon Haykin, John Wiley & Sons ,Inc. 1994
4. Digital and Commuincation system - Roden H.S., PHI
5. Analog and Digital Communication - Chakraborty, Dhanpat Rai
6. Advanced Electronics Communication Systems- Wayne Tomasi, PHI. Edn.

M. Sc. II Year	MPH-E305	Semester-III
ELECTIVE PAPER- I	FUNDAMENTAL ATMOSPHERIC PHYSICS	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

ESSENTIALS OF ATMOSPHERIC PHYSICS

Structure of the atmosphere: Troposhere, Stratopshere, Mesosphere, Thermosphere; Composition of air, Greenhouse effect and enhanced greenhouse effect, Transport of matter, Energy and momentum in nature, Stratification and stability of atmosphere, Laws of motion, Hydrostatic equilibrium, Elements of weather and climate of india. **(12 Lectures)**

UNIT-II

SOLAR AND TERRESTRIAL RADIATION

Physics of radiation, Interaction of light with matter, Rayleigh- and Mie- scattering, Laws of radiation (Kirchoffs law, Planck's law,Beer's law, Wien's displacement law, etc.), Solar and terrestrial spectra, UV radiation, Ozone depletion problem, IR absorption, Energy balance of the earth atmosphere system.

(12 Lectures)

UNIT-III

ATMOSPHERIC MEASUREMENT TECHNIQUES

Ground based measurements of temperature, Pressure and humidity, Airborn measurement of above parameters, Measurement of air, water and noise pollutions, Measurement of precipitation, Measurement of cloud parameters using Radar. **(12 Lectures)**

UNIT- IV

ATMOSPHERIC POLLUTION AND DEGRADATION

Elementry fluid dynamics, Diffusion, Turbulence and turbulent diffusion, Factors governing air, Water and noise pollution, Air and water quality standards, Waste disposal, Heat island effect, Land and see breeze, Puffs and plumes, Gaseous and particulate matters, Wet and dry deposition.

Residence time and reaction rates of pollutants, Sulphur compounds, Nitrogen compounds, Carbon compounds, Organic compounds, Aerosols, Toxic gases and radioactive particles, Trace gases. **(12 Lectures)**

UNIT-V

GLOBAL AND REGIONAL CLIMATE

Elements of weather and climate, Stability and vertical motion of air, Horizontal motion of air and water, General circulation & climate, Pressure gradient forces, Viscous forces, Inertia, Reynolds number, Energy balance-a zero- dimensional green house model, Global climate models. **(12 Lectures)**

Text Books / Reference Books

1. Meteorology for Scientists & Engineers- Ronald B. Still, Brooks/ Cole Cengage Learning 1995.
2. Environmental Physics - Edbert B. and Reink V. Groundelle, John Wiley
3. The Physics of Atmosphere - J.T. Hougtion, Cambridge Univ. Press, 1977.

M. Sc. I Year	MPH-E306	Semester-II
ELECTIVE PAPER- II	ADVANCED ATMOSPHERIC PHYSICS	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

ATMOSPHERIC THERMODYNAMICS

Gas laws: Virtual temperature, Hydrostatic equation: Geopotential, Scale height, Constant pressure surfaces, Reduction of pressure to sea level, First law of thermodynamics: Joule's law, Specific heats & enthalpy, Adiabatic processes: Air parcel & dry adiabaic lapse rate, Potential temperature, Thermodynamic diagrams, Water vapour in air: Moisture parameters, Pseudoadiabatic processes & saturated adiabatic lapse rate, Equivalent and wet bulb potential temperatures, Normand's rule, Ascent decent effect, Static stability : Unsaturated & saturated air, Conditional & convective stability, Second law of thermodynamics: Carnot cycle, entropy, Clausius - Clapeyron equation. **(12 Lectures)**

UNIT-II

CLOUD FORMATION & MICROPHYSICS OF CLOUD

Theory of nucleation of water vapour & cloud condensation nuclei, Microstructure of warm clouds, Cloud liquid water content & entrainment, Growth of cloud droplets in warm clouds: By condensation, By collection, By collission-coalescence, Microphysics of cold clouds: Nucleation, Growth & concentration of ice particles, Formation of precipitation in cold clouds, Artificial modification of clouds & precipitation: Modification of warm & cold clouds, Inadvertent modification. **(12 Lectures)**

UNIT-III

ATMOSPHERIC DYNAMICS

Kinematics of large scale horizontal flow: Elementary properties, Vorticity & divergence, Defotmations, streamlines & trajectories, Dynamics of horizontal flow: Apparent & real forces, Equation of motion, Geostrophic & thermal wind, Vertical motion & planetary rotation vorticity conservation, Potential vorticity, Primitive equations: Vertical coordinate, Hydrostatic balance, Energy equation, Vertical motion field, Solution & application of primitive equations. **(12 Lectures)**

UNIT-IV

ATMOSPHERIC ELECTRICITY & LIGHTNING

Fair weather atmospheric electric fields and currents, Mechanisms of cloud electrification: Precipitation powdered & connective mechanisms, Electrochemical charge separation, Charge structure of the clouds, Thundercloud electric fields.

Lightning initiation in a thundercloud, Cloud to ground and intracoud lightning, Positive lightning, Lightning superbolts, Lightning fields: Electric & magnetic fields, Ratiations from lightning, Application of the lightning electric field measurements, Lightning sprites. **(12 Lectures)**

UNIT-V

NUMERICAL METHODS & WHETHER PREDICTION

Solution to atmospheric equations: Approximate solutions, Parameterizations & models, Grid points, Finite difference equations, Numerical stability, Numerical forcast process: Balanced mass & flow fields, Data assimilation & analysis, Forcasts, Post processing, Refinements, Forcast quality: Accuracy & varification, Elementary non linear dynamics & chaos: Predictability, Lorentz strange attractor, Ensemble forcaster.

(12 Lectures)

Text Books / Reference Books

1. Atmospheric Science - John M. Wallace & Peter V. Hobbs, Academic Press (2006)
2. Meteorology for Scientists and Engineers - Ronald B. Stull, Brocks/Cole Cengage Learning (1995)
3. The Lightning Discharge - Martin A. Uman, Academic Press (1987)
4. Dynamic Meteorology - Holton, J.R., 3rd edition , Academic PressN.Yf. (1992).
5. The Physics of Monsoons - R.N. Keshvamurthy ans M. Shanker Rao, Allied Publishers, 1992
6. Numerical Weather Prediction - G.J. Haltiner and R.T.Villians, John Wiley and Sons, 1980

M. Sc. II Year	MPH-E351	Semester-III
	Lab Course (DIGITAL ELECTRONICS & MICROPROCESSOR LAB)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMENTS

1. Construction and study of logic gates using diode and transistors
2. Study of pin connection, power supply requirement and truth tables of various digital IC's
3. Design and study of control combinational logic network
4. Design and study of different shift registers using IC's
5. Design and study of multiplexer for different modes using IC's
6. Design and study of demultiplexer for different modes
7. Design and study of decoders
8. Design and study of encoders
9. Design and study of different counter modes
10. Design and study of RS, D, JK and T flip-flops
11. Design and study of A/D converter
12. Design and study of D/A converter
13. Study of ITL 742121 as monostable Schmitt trigger
14. Design and study of decode and display circuit using 7448 and FND 507 or other LED
15. Study of basic instructions and programming for simple application of 8085 Microprocessor
16. Study of interfacing of 8251,8255, 8253, 8257 etc.
17. Study of addition, subtraction, multiplication & division using 8085/8086
18. Study of motor speed control, temperature control using 8085/8086
19. Design and study of active filters
20. Study of an experiment using various types of memory elements

Note: 1. Students are required to perform **ten** experiments from the list.
2. In practical examination the student shall be required to perform **one** experiment.
3. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics.

M. Sc. II Year	MPH-E352	Semester-III
	Lab Course (COMMUNICATION ELECTRONICS LAB)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMENTS

1. Study of amplitude modulation & demodulation
2. Study of SSB modulation & demodulation
3. Study of frequency modulation & demodulation
4. Study of AGC and AVC
5. Study of simple radio receiver circuits using IC
6. Study of the characteristics of a superhetrodyne broadcast radio receiver
7. Study of FM receivers
8. Study of the sweep generator using SCR and UJT
9. Determination of antenna constants
10. Study of half wave antenna
11. Study of Marconi antenna
12. An elementary study of antenna array
13. Study of Yagi antenna
14. An elementary study of broadcast transmitter
15. An elementary study of coaxial and parallel transmission lines
16. Ionospheric study (i) critical frequency (ii) virtual height (iii) signal strength

Note:
1. Students are required to perform **ten** experiments from the list.
2. In practical examination the student shall be required to perform **one** experiment.
3. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics.

M. Sc. II Year	MPH-E351				Semester-III
	Lab Course (ATMOSPHERIC PHYSICS-I LAB)				
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

1. Measurement of solar radiations (Solarimeter)
2. Wind direction and speed measurement
3. Measurement of rainfall
4. Measurement of aerosols
5. Numerical weather modelling
6. Wind fabric diagram
7. Measurement of humidity
8. Measurement of atmospheric attenuation of laser radiation
9. Measurement of particulate matter(Man made or indusreial)
10. Measurement of ozone in atmosphere

Note: 1. In practical examination the student shall be required to perform **One** experiment.
2. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics

M. Sc. II Year	MPH-E353	Semester-III
	Lab Course (GENERAL ATMOSPHERIC LAB)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMETS

1. Laboratory simulation of cloud formation and to study the effect of aerosols, ions, electric field on it
2. Simulation of atmospheric electric field
3. Measurement of atmospheric electrostatic field
4. Measurement of lightning radiation at VLF
5. Measurement of lightning radiation at HF
6. Experiments on lightning protector
7. Analysis of rain water using UV spectrophotometer
8. Measurement of parallel and perpendicular components of atmospherics
9. Effect of electrostatic field on mice and rates
10. Effect of pollution on some animals(rats etc.)

Note:
1. In practical examination the student shall be required to perform **one** experiment.
2. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics

M. Sc. II Year		MPH-401			Semester-IV
		PHYSICS OF NUCLEI & PARTICLES			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

NUCLEAR INTERACTION AND NUCLEAR REACTIONS

Nucleon: nucleon interaction, Exchange forces and tensor forces, Meson theory of nuclear forces, Nucleon-nucleon scattering, Effective range theory- Spin dependence of nuclear forces, Charge independence and charge symmetry of nuclear forces, Iosospin formalism ,Yukawa interaction.

Direct and compound nuclear reaction mechanisms, Cross sections in terms of partial wave amplitudes, Compound nucleus, Scattering matrix, Reciprocity theorem, Breit-Wigner formula. **(12 Lectures)**

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 momenta and parities of nuclear ground states, Qualitaive discussion and estimates of transition rates, Magnetic moments and Schmidt lines, Collective model.

(12 Lectures)

UNIT-III

NUCLEAR DECAY

Alpha decay, Beta-decay, Fermi theory of beta decay, Shape of the beta spectrum, Total decay rate, Angular momentum and parity selection rules, Comparative half lives, Allowed and forbidden transitions, Selection rules, Parity violation, Two component theory of neutrino decay, Multipole transitions in nuclei : Angular momentum and parity, Selection rules, Internal conversion, Nuclear isomerism. **(12 Lectures)**

UNIT-IV

ELEMENTARY PARTICLES

Types of interaction between elementary particles, Hadrons and leptons, Symmetry and conservation laws, Elementary ideas of CP and CPT invariance, Classification of hadrons, Lie algebra, SU(2), SU(3) multiplets, Quark Model, Gell-Mann, Okubo mass formula for octet and decuplet hadrons, Charm, Bottom and top quarks. **(12 Lectures)**

UNIT-V

NUCLEAR INSTRUMENTATION

Ionization chamber, Geiger-Muller counter, Scintillation counter, Semiconductor detecctor, Bubble chamber, Spark chamber, Nuclear Emulsions, Cerenkov Counters, Van De Graff accelerator, Cyclotron, Phase stability principle, Synchrotrons, Colliding beam, Betatron, Basic introduction to large hadron collider (LHC).

(12 Lectures)

Text Books / Reference Books

1. Nuclear Physics - I. Kalplan, Narosa, Madras
2. Atomic nucleus - R. D. Evans, McGraw Hill, N York
3. Concepts of Nuclear Physics - B.L. Cohen, MGH, Bombay, 1971
4. Nuclear Physics - R.R. Roy and B.P. Nigam, Wiley- Eastern Ltd., 1983
5. Introduction to Experiemntal Nuclear Physics - R.M. Singru, John Wiley & Sons
6. Atomic and Nuclear Physics vol.2 - Ghoshal,
7. Introduction to nuclearPhysics- H.A. Enge, Addison -wesley, 1975
8. Introduction to high energy Physics - P.H.Perkins, Addison-wesley, London, 1982
9. Quarks, Leptons - F. Halzen and A.D. Martin, John Wiley & sons, N York
10. Modern Elementary Particle Physics- G. Kare, Edition Wiseley

M. Sc. II Year	MPH-402	Semester-IV

		PHYSICS & VEDIC THOUGHT			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
30	**3 Hrs**	**30**	**70**	**100**	**02**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

SCIENTIFIC UNDERSTANDING OF VEDAS

Vedangas, Symbolism in Vedas, The Vedic Gods(Devas)
(Rg. 1.164.44, Atharva 10.8.31, Rg. 10.5.7,10.190.1) , Common threads between Modern Physics and Vedic Thoughts, Vedic units of measurement of mass, Length and time. **(6 Lectures)**

UNIT-II

ENERGY

(Rg.10.72.4, 10.90.16, 10.130.1, 1.164.13, 10.82.6, Atharva 10.8.10,11.1.1)
(Yajul 12-24,25; Rg.2.2.9;Rg 3-1-9; Rg. 8.19.7), Physics and Thought Energy. **(6 Lectures)**

UNIT-III

HEAT, LIGHT, MEGNETISM, ELECTRICITY AND ATOMIC THEORY

(Rg.10.45.1, 10.45.3, 2.1.1),(Yaju. 23.5.2, Rg. 10.81.3, 10.72.6)
(Rg. 5-89 Supta; Rg. 8-101,1.2; Rg1.88,1-5) **(6 Lectures)**

UNIT-IV

COSMIC RAYS

Yayo group(heat waves), Marichi group, Vayu group, Marut group, Ribhu group (Rg.10.140.1, 10.45.8, 1.136.3, 5.59.7, 5.57.4, 5.54.3, 5.55.3, 1.88.1, 2. 34.3, 2.34.2, 1.31.1, 1.64.5, 1.164.47, 1.164.51, 1.110.4), (Rg1.8.8,1.5; Rg 1.87.4, Rg 1.64.9, Rg. 1.36.8). **(6 Lectures)**

UNIT-V

UNIVERSE

The Dynamic Universe, Estabilisation and expansion of Universe, Creation and dissolution of universe, Comparison with the theory of oscillatory universe,
(Rg. 10.129; 1-7 (Big Bang Theoy); Rg. 10.1.6; Yaju 3-12,14-23,Ath 19.9.80; Rg 1.164.13)
(6 Lectures)

Text Books / Reference Books

1. The Call of Vedas - Abinash Cahndra Bose
2. Cosmology of the Rigvedas (London 1887) - W. Wallis
3. Physics in ancient India - Narayen Gopal Dongre
4. Science in Vedas - Acharya V.N. Shastri
5. The Vedas - Jeanire Miller, Rider & Co., London
6. Vedas: The Source of Ultimate Science, S.R. Verma, Nag Publishers (2005 Ed.)

M. Sc. II Year	MPH-E403	Semester-IV
ELECTIVE PAPER III	COMMUNICATION ELECTRONICS–II	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

SIGNAL ANALYSIS & SAMPLING

System and signals, Signal representation using Fourier series, Signal representation using Fourier transform, Power spectral density.

Sampling theorem- Low Pass and Band Pass signals, PAM, Channel BW for a PAM signal, Natural sampling, Flat-top sampling, Signal recovery through Holding, Quantization of signals, Quantisation error.

(12 Lectures)

UNIT-II

PULSE MODULATION SYSTEMS

PCM, Differential PCM, Delta modulation, Adaptive delta modulation, Noise in pulse code and delta modulation Systems: Calculation of quantization noise, Output signal power, Output signal-to-noise ratio in PCM.

(12 Lectures)

UNIT-III

DIGITAL MODULATION TECHNIQUES

Binary phase shift keying **(**BPSK), Differential phase shift keying (DPSK), Quadrature phase shift keying (QPSK), Binary freuquency shft keying (BFSK).

(12 Lectures)

UNIT-IV

MICROWAVE COMMUNICATION

Principle of velocity modulation, Reflex klystron and magnertron, Advantages and disadvantages of microwave transmission, Loss in free space, Propagation of microwaves, Atmospheric effects on propagation, Fresnel zone problem, Ground reflection.

(12 Lectures)

UNIT-V

RADAR SYSTEMS AND SATELLITE COMMUNICATION

Radar block diagram and operation, Radar range equation, Minimum detectable signal, Receiver noise, Radar cross- section, Pulse repeitition frequency, Antenna parameters, Radar transmitters and receivers.

Satellite communcations: Orbital and geostationary satellites, Orbital patterns, Look angles, Orbital spacings, Satellite systems, Link modules. **(12 Lectures)**

Text Books / Reference Books

1. Principles of communication systems, 2/e - Taub and Schilling, TMH
2. Digital and Commuincation system - Roden H.S., PHI
3. Analog and Digital Communication - Chakraborty, Dhanpat Rai
4. Advanced Electronics Communication Systems - Wayne Tomasi., PhI. Edn.
5. Digital and Analog Communication System- K. San Shanmugam, John Wile & Sons
6. Microwaves- K.L. Gupta, Wiley Eastern Ltd., New Delhi
7. Satellite communication - D.C. Agrawal

M. Sc. II Year	MPH-E404	Semester-IV
ELECTIVE PAPER III	BIO-EFFICT OF ATMOSPHERIC FIELDS	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**4 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

DIELECTRIC PROPERTIES OF TISSUES

Definition and basic concepts, General relaxation theory, Distribution of relaxation times, Kramers- Kronig relations, Interfacial polarization (Maxwell-Wagner effect), Two slabe in series, Dilute suspension of spherical particles and membrane covered spheres, Dipolar relaxation mechanism, Counterion polarization effects, Dielectric dispersion in conductivity and permitivity of tissues.

(12 Lectures)

UNIT-II

BIO-EFFECTS OF DC AND ELF ELECTRIC FIELDS

Physics of the interaction of electric fields with biological materials, Effect of electric fields on cell membranes, Non-linear effect of AC fields on cells, Thermal effects, Natural and man-made fields, Man-made fields in typical living environment, Observed electric field effect on biological systems, Medical applications.

(12 Lectures)

UNIT-III

BIO-EFFECTS OF STATIC MAGNETIC FIELDS

Physiological and medical applications of magnetism, Cells biomolecules and chemical reaction in magnetic fields, Mutagenic, Mitogenic, Morphological and development effects of magnetic fields, Geomagnetic fields in the orientation and homing of organisms.

(12 Lectures)

UNIT-IV

BIO-EFFECTS OF ELF MAGNETIC FIELDS

Human exposure of ELF magnetic fields, Mechanism of interaction of ELF magnetic fields, Experimental studies on ELF megnetic field effects: Interaction with electrically excitable tissues and behaviour effects, Cellilar and tissue interactions, Cancer related studies, Human health studies: Residential and occupational exposure and cancer risk, Epidemiological studies.

(12 Lectures)

UNIT-V

THERAPEUTIC APPLICATIONS OF BIO-EFFECTS

Modern magneto-therapies: Fundamental strategies, Supportive evidence, Current status, Direct current and bone growth: Bone properties, Electricity and bone, Application of electrical energy, Clinical use of dc currents, Electroacupuncture: Theories,Anatomy and effects of acupuncture, Auricular & electro acupuncture, Complications of & indications for acupuncture treatment.

(12 Lectures)

Text Books / Reference Books

1. Handbook of Biological effetcs of Electromagnetic fields - C. Polk and E. Postow, C.R.C. Pres Boca Raton 1996
2. Modern Bioelectricity - A.A. Marino, Marcel Dekker Inc New York, 1988.

M. Sc. II Year	MPH-E451	Semester-IV
	Lab Course (ADVANCED COMMUNICATION ELECTRONICS LAB)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

LIST OF EXPERIMETS

1. To study pulse amplitude modulation/demodulation
2. To study pulse position /pulse width modulation /demodulation
3. To study phase modulation
4. To study FSK modulation/ demodulation using timer/PLL
5. To study microwave characteristics and measurement
6. To study solid state microwave oscillator
7. To study PLL circuits and applications
8. To study fibre optics communication
9. To study trouble shooting using signal analyzer
10. To study assembler language programming on PC
11. To study experiments based on computer aided design
12. To study PCM-PDM
13. To study TDM-PAM
14. To study sampling and reconstruction
15. To study PSK, QSK modulation techniques
16. To study PAM wave form
17. To study delta modulation, adaptive delta modulation
18. To study sigma modulation and demodulation techniques
19. To study mircowave communication systems
20. To study microwave antennas

Note:
1. Students are required to perform **ten** experiments from the list.
2. In practical examination the student shall be required to perform **one** experiment.
3. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics.

M. Sc. II Year	MPH-E452	Semester-IV
	Lab Course (ADVANCED ATMOSPHERIC PHYSICS LAB)	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
120	**4 Hrs**	**30**	**70**	**100**	**04**

1. Measurement of gaseous pollutant (SO_2,CO_2,NO,O_3)
2. Measurement of solar UV radiation
3. To study biological effect of ELF fields (on animals)
4. To study biological effect of strong magnetic fields(on animals)
5. To study monitoring of noise pollution
6. To study on water pollution
7. To study on soil pollution

Note:
1. In practical examination the student shall be required to perform **one** experiment.
2. Addition or deletion in the above lists may be made in accordance with the facilities available with the approval of H.O.D. Physics

M. Sc. II Year	MPH-E411	Semester-IV
ELCETIVE PAPER IV/V	PHYSICS OF NANO MATERIALS	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT I

Nanostructures & Structural Characterization : History – background – nanoscale in one dimension, two dimensions, three dimensions – Synthesis of oxide nanoparticles (Sol-gel processing), metallic nanoparticles: semiconductor nanoparticles, fabrication of core – shell nanostructures – aerosol synthesis – gas phase synthesis of nanoparticles – Structural characterization – X-ray diffraction – STM, Atomic force microscopy, properties of nano materials.

UNIT II

Carbon Nanotubes : Carbon allotropes – types of carbon nanotubes – graphene sheet to single walled carbon nanotubes – electronic structure of carbon nanotubes – synthesis of carbon nanotubes: electric arc discharge method – laser method – electrolysis – pyrolysis of hydrocarbons – Fluidised bed CVD method – solar production of CNT – purification methods – properties – filling of CNT – fullerene – purification – properties – application of CNT .

UNIT III

Quantum Heterostructures: Introduction – heterostructure – growth of heterostructure: molecular beam epitaxy – metal organic chemical vapour deposition – heterojunction band alignment – quantum well – superlattice – low dimensional system -– doped heterostructures: modulation doping – quantum wells in heterostructures – effective mass theory in heterostructures – application of effective mass theory in quantum wells in heterostructures – optical confinement – application of heterostructures.

UNIT IV

Quantum wires & Quantum dots: Introduction – size effects - preparation of quantum nanostructures – Fermi gas and density of states – calculation of density of states – infrared detector – quantum well lasers – quantum cascade laser – nanowires – production, structure and uses of nanowires – quantum dots: fabrication techniques – electronic properties - application of quantum dots: information storage – infrared photodetector – laser.

UNIT V

Magneto Electronics and Applications of Nano Technology:

Magnetism in nanocrystals – Nanocrystalline soft magnetic materials – Columb blockade – single electron transistor – quantum cellular automata – fabrication – Spintronics – giant magnetoresistance – Quantum Hall effect – Quantum spin Hall effect – fractional quantum Hall effect – application of nanotechnology – medical application of molecular nanotechnology.

BOOKS FOR REFERENCE

1. Optical Properties of Semiconductor Quantum Dots, U. Woggon Springer Verlog.
2. Nanophysics edited by Dr. Sr. Gerardin Jayam.
3. Transport in Semiconductor nanostructure, D. Ferry and S. Goodnick, Cambridge University Press, 1997.
4. Nanotechnology in Carbon Materials, M. S. Dresselhaus and R. Salio .
5. Advanced Magnetic nanostructures, K. P. Awasthi, Cyber Tech Publications,2008.
6. Introduction to Nanotechnology , Charles P. Poole Jr, Frank.J.Owens, Wiley India Pvt. Ltd, 2008.

M. Sc. II Year	MPH-E412	Semester-IV
ELCETIVE PAPER IV/V	**ELECTRONIC DEVICES**	

Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT I

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

UNIT II

Photonic Devices: Eradicative and non radiative transitions – Optical absorption- Bulk and thin film – Phtotoconductive devices(LDR) – diode photodetectors – solar cell – (open circuit voltage and short circuit current, fill factor) – LED (high frequency limit – effect of surface and indirect combination current, operation of LED) – diode lasers (conditions for population inversion in active region, line confinement factor) – Optical gain and threshold current for lasing – Fabry-Perrot cavity length for lasing and the separation

UNIT III

Memory Devices: Static and Dynamic random access memories SRAM and DRAM – CMOS and NMOS – non-volatile – NMOS – magnetic – optical and ferroelectric memories – charge coupled (CCD)

UNIT IV

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 of these devices – Piezoelectric – Electrostrictive and Magnetostrictive Effets - Important material 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

UNIT V

Microwave Devices: Tunnel diode – Transfer electron devices (Gunn diode) – Avalanche transit time devices – Impatt diodes – parametric devices.

BOOKS FOR STUDY

1 . Semiconductor Devices- Physics and Technology, S.M. Sze, John *Wiley* & Sons, *1985*

2 . Introduction to Semiconductors Devices, M.S. Tyagi, *John Wiley & Sons, 1991*

3 . Measurment, Instrumention and Experiment Design in Physics and Engineering,
M. Sayer and A. Mansingh, Prentice Hall, India, 2000.

4 . Optical Electronics, Ajoy Ghatak and K. Thyagarajan, Cambridge Univ. Press,1989

M. Sc. II Year		MPH-E413			Semester-IV
ELCETIVE PAPER IV/V		RENEWABLE ENERGY SOURCES			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT I

Introduction : Primary and Secondary energy– commercial and non – commercial energy – renewable and non– renewable energy resources and their importance – world energy use– reserves of energy resources – energy cycle of earth – Indian energy scenario – Long term energy scenario for India – environmental aspects of utilization.

UNIT II

Solar Energy: Introduction– extra terrestrial solar radiation– radiation at ground level – collectors – solar cells – application of solar energy – Biomass energy – biomass conversion – bio gas production – ethanol production – pyrolysis and gasification – direct combustion – applications.

UNIT III

Wind Energy: Introduction – basic theory – types of turbines – applications

Geothermal energy – Introduction – geothermal resources types – resource base– application for heating and electricity generation– Tidal energy – Introduction – origin of tides – power generation scheme – Wave energy – Introduction – basic theory – wave power devices.

UNIT IV

Other Renewable Energy Sources: Introduction – open and closed OTEC cycles – biophotolysis – ocean currents – Hydropower – introduction – basic concept– site selection – types of turbine – small scale hydropower– Magneto hydrodynamics (MHD), Thermoelectric and Thermionic energy resources – basic principles – power generation – Nuclear energy – basic principle – power generation (basic ideas only).

UNIT V

Chemical Energy Sources: Introduction – Fuel cells-design and principle– classification – types-advantages and disadvantages – applications – Batteries– introduction – theory– different types of batteries arrangements – classification of batteries – advantages of batteries for bulk storage – Hydrogen energy – production– electrolysis – thermochemical methods – solar energy method – hydrogen storage.

BOOKS FOR REFERENCE

1. Solar Energies of Thermal Processes, A.Duffie and W.A.Beckmann, John-Wiley,1980.
2. Principle of Solar Engineering, F.Kreith and J.F.Kreider, McGraw-Hill,1978
3. Alternate Energy Sources, T.N. Veziroglu, Vol.5 and 6, McGraw –Hill,1978.
4. Solar Energy -Principles of Thermal Collection and Storage, *S P Sukhatme* and J K Nayak, Tata Mc Graw Hill.Tata, 2008
5. Non-Conventional Energy Sources, G.D. Rai, Khanna publishers, New Delhi,1984

M. Sc. II Year		MPH-E414			Semester-IV
ELCETIVE PAPER IV/V		OPTOELECTRONICS AND LASERS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT I

Light wave fundamentals: Electromagnetic waves -dispersion – pulse distortion – and information rate – polarisation- resonant cavities at plane boundary – critical angle – reflections.

UNIT II

Integrated wave guides: Dielectric slab guide – modes in the symmetric slab guide – modes in the asymmetric slab wave guide – coupling to the wave guide- integrated optical network.

UNIT III

Optic fiber wave guides : Step index fiber – graded index fibre – attenuation in fibers – modes in step index fiber – modes in graded index fibre pulse distortion and information rate in optic fibers – construction of optical fibers.

UNIT IV

Lasers : Emission and absorption of radiation- Einstein relations – absorption of radiation- population inversion – threshold conditions – laser losses - line shape functions – population inversion and pumping threshold conditions - Laser modes – Axial modes -Transverse modes- classes of laser - doped insulator laser - semiconductor laser - gas lasers - liquid gas lasers- single mode operation- frequency stabilization - mode locking - active mode-passive mode locking- Q-switching methods

UNIT V

Holography: Wavefront reconstruction – linearity of holographic process – image formation of holographic process – Gabor hologram – limitations – Recording the hologram – minimum reference angle – holography of three dimensions – practical problems in holography – types of holograms- Fresnel - Fraunhofer – transmission- reflection – rainbow multiplex- embossed and thick holograms - application of holography – holography interferometry – holography computer memories.

BOOKS FOR STUDY

1. Fiber Optic Communications, Joseph C. Palais, Prentice Hall Publications. IV Edition (Unit 1-3)
2. Optoelectronics, J. Wilson and J.F.B.Hawkes, Prentice Hall Publications,1989 (Unit 4)
3. Introduction to Fourier Optics, Joseph W.Goodman, McGraw Hill, Person Education II Edition, 1996. (Unit 5)

BOOKS FOR REFERENCE

1. Photonics Optical Electronics in Modern Communications, Amnon Yariv and Pochi Yeh, Oxford University Press, VI Edition, 2006
2. Optical Fibers and Fiber Optic Communication Systems, Subir Kumar Sarkar, S. Chand & Co
3. Introduction to Fiber Optics, *Ajoy Ghatak* and K. *Thyagarajan*, Tata McGraw Hill

M. Sc. II Year	MPH-460 DISSERTATION	Semester-IV
Report		**100**
Viva-voce/Presentation		**50**
Seminar (Internal)*		**30**
Diary (Periodic ssessment)**		**20**
TOTAL		**200**

The student is required to undergo a dissertation in the IV Semester. The course will be based on preliminary research oriented topics both in theory and experiment. The teacher who will act as supervisor for the dissertation will float topic of the dissertation and any one of them will be allotted to the student.

Supervisor for each student and topic of the dissertation shall be notified at the end of II Semester and the student will carry the work throughout the III and IV Semesters (second year). A departmental committee will approve the subject/topic of dissertation. The dissertation shall have to be submitted at the end of IV semester up to 10^{th} May.

The student shall be required to maintain a diary showing the progress report of the dissertation, which will be submited by him for examination and evaluation. The diary should be countersigned by the supervisor periodically.

The candidate can perform his dissertation work either at GKV Haridwar or at any other Organization/Industry approved by H.O.D. Physics. A person of the concerned Organization/Industry not below the rank of Assistant Professor can act as co-supervisor on the recommendation of Head /Manager of that Institution and approved by the departmental committee .