Dr. B. R. AMBEDKAR UNIVERSITY, SRIKAKULAM

General Regulations relating to

POST GRAUDATE AND PROFESSIONAL COURSES
Syllabus under Credit Based Semester System

(with effect from 2010-2011)

1. Candidates seeking admission for the Masters/Professional Degree Courses shall be required to have passed the qualifying examination prescribed for the course of any University recognized by Dr. B.R. Ambedkar University, Srikakulam as equivalent there to

2. The course and scope shall be as defined in the Scheme of Instruction and syllabus prescribed.

3. The course consists of 2/4/6 semesters, @ two semesters/year, unless otherwise specified.

4. The candidates shall be required to take an examination at the end of each semester of the study as detailed in the Scheme of Examination. Each semester theory paper carries a maximum of 100 marks, of which 85 marks shall be for semester-end theory examination of the paper of three hours duration and 15 marks shall be for internal assessment

4. (a) Internal Assessment for 15 Marks: Two mid-term exams, one conventional (descriptive) and the second – 'on-line' with multiple choice questions for each theory paper shall be conducted. The average of these two mid-term exams shall be taken as marks obtained for the paper under internal assessment. If any candidate appears for only one mid-term exam, the average mark, dividing by two shall be awarded. If any candidate fails to appear for both the mid term exams of a paper, only marks obtained in the theory paper shall be taken into consideration for declaring the result. Each mid-term exam shall be conducted only once.

4. (b) Candidates shall be declared to have passed each theory paper if he/she obtains not less than E Grade ie., an aggregate of 40 % of the total marks inclusive of semester-end and internal assessment marks in each paper.

5. A candidate appearing for the whole examination shall be declared to have passed the examination if he/she obtains a Semester Grade Point (SGP) of 5.0 and a CGPA of 5.0 to be declared to have passed the Course.

6. Not withstanding anything contained in the regulations, in the case of Project Report/Dissertation/ Practical/Field Work/Viva-voce etc., candidates shall obtain not less than D grade, i.e., 50% of marks to be declared to have passed the examination.

7. ATTENDANCE: Candidates shall put in attendance of not less than 75% of attendance, out of the total number of working periods in each semester. Only such candidates shall be allowed to appear for the semester-end examination.

7. (a) A candidate with attendance between 74.99% and 66.66% shall be allowed to appear for the semester-end examination and continue the next semester only on medical and other valid grounds, after paying the required condonation fee.

7. (b) In case of candidates who continuously absent for 10 days without prior permission on valid grounds, his/her name shall automatically be removed from the rolls.

7 (c) If a candidate represents the University at games, sports or other officially organized extra-curricular activities, it will be deemed that he/she has attended the college on the days/periods

8 Candidates who put in a minimum of 50% attendance shall also be permitted to continue for the next semester. However, such candidates have to re-study the semester course only after completion of the course period for which they are admitted. The candidate shall have to meet the course fees and other expenditure.

9 Candidates who have completed a semester course and have fulfilled the necessary attendance requirement shall be permitted to continue the next semester course irrespective of whether they have appeared or not at the semester-end examination, at their own cost.

Such candidates may be permitted to appear for the particular semester-end examination only in the following academic year; they should reregister/ reapply for the Semester examination.

The above procedure shall be followed for all the semesters

10. Candidates who appear and pass the examination in all the papers of each and every semester at first appearance only are eligible for the award of Medals/Prizes/Rank Certificates

11. BETTERMENT: Candidates declared to have passed the whole examination may reappear for the same examination to improve their SGPA, with the existing regulations without further attendance, paying examination and other fees. Such reappearance shall be permitted only with in 3 consecutive years from the date of first passing the final examination. Candidates who wish to appear thereafter should take the whole examination under the regulations then in vogue.

12. The semester-end examination shall be based on the question paper set by an external paper-setter and there shall be double valuation for post-Graduate courses. The concerned Department has to submit a panel of paper-setters and examiners approved by the BOS and the Vice-chancellor nominates the paper-setters and examiners from the panel.

13. In order to be eligible to be appointed as an internal examiner for the semester-end examination, a teacher shall have to put in at least three years of service. Relaxation of service can be exempted by the Vice-Chancellor in specific cases.

14. If the disparity between the marks awarded in the semester-end examination by internal and external examiners is 25% or less, the average marks shall be taken as the mark obtained in the

paper. If the disparity happens to be more, the paper shall be referred to another examiner for third valuation. In cases of third valuation, of the marks obtained either in the first or second valuation marks, whichever is nearest to the third valuation marks are added for arriving at the average marks.

15. Candidates can seek revaluation of the scripts of the theory papers by paying the prescribed fee as per the rules and regulations in vogue.

16. The Project Report/Dissertation/ Practical/Field Work/Viva-voce etc shall have double valuation by internal and external examiners.

17. A Committee comprising of the HOD, one internal teacher by nomination on rotation and one external member, shall conduct viva-voce examination. The department has to submit the panel, and the Vice-chancellor nominates viva-voce Committee.

18. Grades and Grade Point Details (with effect from 2009-10 admitted batches)

S. No	Range of Marks	Grade	Grade Points
1.	> 85 %	**O**	10.0
2.	75 % – 84 %	**A**	9.0
3.	67 % - 74 %	**B**	8.0
4.	58 % - 66 %	**C**	7.0
5.	50 % - 57 %	**D**	6.0
6.	40 % - 49 %	**E**	5.0
7.	< 39 %	**F (Fail)**	0.0
8.	Incomplete: (*Shall be upgraded from E to O Grade on subsequent appearance of the same semester. The corresponding Grade Points will be awarded)*	**I**	

19. Calculation of **SGPA** (Semester Grade Point Average) **& CGPA (**Cumulative Grade Point Average):

For example, if a student gets the grades in one semester A,A,B,B,B,D in six subjects having credits 2(S1), 4(S2), 4(S3), 4(S4), 4(S5), 2(S6), respectively. The SGPA is calculated as follows:

$$\textbf{SGPA} = \frac{\{9(A)x2(S1)+9(A)x4(S2)+8(B)x4(S3)+8(B)x4(S4)+8(B)x4(S5)+6(D)x2(S6)\}}{\{2(S1)+4(S2)+4(S3)+4(S4)+4(S5)+2(S6)\}} = \frac{162}{20} = 8.10$$

i. A student securing ‘F’ grade thereby securing 0.0 grade points has to appear and secure at least ‘E’ grade at the subsequent examination(s) in that subject.

ii. If a student gets the grades in another semester D, A, B, C, A, E, A, in seven subjects having credits 4(S1), 2(S2), 4(S3), 2(S4), 4(S5), 4(S6), 2(S7) respectively,

$$\textbf{SGPA} = \frac{\{6(D)x4(S1)+9(A)x2(S2)+8(B)x4(S3)+7(C)x2(S4)+9(A)x4(S5)+5(E)x4(S6)+9(A)x2(S7)\}}{\{4(S1)+2(S2)+4(S3)+2(S4)+4(S5)+4(S6)+2(S7)\}} = \frac{162}{22} = 7.36$$

$$\textbf{CGPA} = \frac{(9x2+9x4+8x4+8x4+6x2+6x4+9x2+8x4+7x2+9x4+5x4+9x2)}{(20+22)} = \frac{324}{42} = 7.71$$

a) A candidate has to secure a minimum of 5.0 SGPA for a pass in each semester in case of all PG and Professional Courses. Further, a candidate will be permitted to choose any paper(s) to appear for improvement in case the candidate fails to secure the minimum prescribed SGPA/CGPA to enable the candidate to pass at the end of any semester examination.

b) There will be no indication of pass/fail in the marks statement against each individual paper.

c) A candidate will be declared to have passed if a candidate secures 5.0 CGPA for all PG and Professional Courses.

d) The Classification of successful candidates is based on **CGPA** as follows:
   i) **Distinction** –CGPA 8.0 or more;
   ii) **First Class** –CGPA 6.5 or more but less than 8.0
   iii) **Second Class** –CGPA 5.5 or more but less than 6.5
   iv) **Pass** –CGPA 5.0 or more but less than 5.5

e) Improving CGPA for betterment of class will be continued as per the rules in vogue.

f) CGPA will be calculated from II Semester onwards up to the final semester. CGPA multiplied by “10” gives aggregate percentage of marks obtained by a candidate.

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M.Sc. Physics

ANNEXURE – I
Eligibility

Course	Qualifying Examination for Admission
M Sc Physics	B. Sc with Physics (as main wherever applicable), Mathematics and any other science subject

ANNEXURE – II

M.Sc. Physics
SCHEME OF INSTRUCTION

First Semester:

No.	Title of the Paper	Compulsory/Elective	No. of Periods of Instruction per Week
101	Classical Mechanics	Compulsory	6
102	Introductory Quantum Mechanics	Compulsory	6
103	Mathematical Methods of Physics	Compulsory	6
104	Electronic Devices and Circuits	Compulsory	6
105	Modern Physics: Lab-I	Compulsory	12
106	Electronics: Lab-II	Compulsory	12

Second Semester:

Course No.	Title of the Paper	Compulsory/Elective	No. of Periods of Instruction per Week
201	Electro Dynamics	Compulsory	6
202	Statistical Mechanics	Compulsory	6
203	Atomic and Molecular Physics	Compulsory	6
204	Nuclear and Particle Physics	Compulsory	6
205	Modern Physics: Lab-II	Compulsory	12
206	Electronics: Lab-II	Compulsory	12

Third Semester:

Course No.	Title of the Paper	Compulsory/Elective	No. of Periods of Instruction per Week
301	Solid State Physics	Compulsory	6
302	Lasers and Fiber Optics	Compulsory	6
303	Digital Electronics & Micro Processors	Compulsory	6
304	Radar Systems and Satellite Communication	Compulsory	6
305	Digital Electronics: Lab	Compulsory	12
306	Solid State Physics: Lab	Compulsory	12

Fourth Semester:

Course	Title of the Paper	Compulsory/Elective	No. of Periods of Instruction per Week
401	Advanced Quantum Mechanics	Compulsory	6
402	Properties and Characterization of Materials	Compulsory	6
403	Communication Electronics	Compulsory	6
404	Antenna Theory and Radio-wave Propagation	Compulsory	6
405	Micro Processor: Lab	Compulsory	12
406	Communication Lab	Compulsory	12

During all the four semesters the medium of instruction and writing examination is ENGLISH only.

Annexure - III

Scheme of Examination as per Credit System

First Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal assessment/ viva-voce and record
101	Classical Mechanics	4	100	85	15
102	Introductory Quantum Mechanics	4	100	85	15
103	Mathematical Methods of Physics	4	100	85	15
104	Electronic Devices and Circuits	4	100	85	15
105	Modern Physics: Lab-I	4	100	75 (Practical) 25 (Record)	
106	Electronics: Lab-	4	100	75 (Practical) 25 (Record)	
Total		**24**	**600**	**540**	**60**

Second Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment / viva-voce and record
201	Electro Dynamics	4	100	85	15
202	Statistical Mechanics	4	100	85	15
203	Atomic and Molecular Physics	4	100	85	15
204	Nuclear and Particle Physics	4	100	85	15
205	Modern Physics: Lab-II	4	100	75 (Practical) 25 (Record)	
206	Electronics: Lab-II	4	100	75 (Practical) 25 (Record)	
Total		**24**	**600**	**540**	**60**

Third Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment/viva-voce and record
301	Solid State Physics	4	100	85	15
302	Lasers and Fiber Optics	4	100	85	15
303	Digital Electronics & Micro Processors	4	100	85	15
304	Radar Systems and Satellite Communication	4	100	85	15
305	Digital Electronics: Lab	4	100	75 (Practical) 25 (Record)	
306	Solid State Physics: Lab	4	100	75 (Practical) 25 (Record)	
Total		**24**	**600**	**540**	**60**

Fourth Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment/ viva-voce and record
401	Advanced Quantum Mechanics	4	100	85	15
402	Properties and Characterization of Materials	4	100	85	15
403	Communication Electronics	4	100	85	15
404	Antenna Theory and Radio-wave Propagation	4	100	85	15
405	Micro Processor: Lab	4	100	75 (Practical) 25 (Record)	
406	Communication Lab	4	100	75 (Practical) 25 (Record)	
		24	**600**	**540**	**60**

Total Marks: - First, Second, Third & Fourth Semesters put together: 600+600+600+600 =2400

Total Credits: - First, Second, Third & Fourth Semesters put together: 24+24=24+24+ = 96

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M.Sc. Physics

I Semester

101: CLASSICAL MECHANICS.

UNIT-I: Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. .Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetryproperties,Energy function and the conservation of Energy

Chapter : 2. Section : 1, 2, 3, 5, 6

UNIT-II: Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

Chapter : 7 Section: 1, 2,3,4 5 .

UNIT-III: Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

Chapter : 8. Section : 1 , 2 ,4, 5, 6 & 7.

UNIT-IV:

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

Chapter : 9. Section : 1, 2, 3, & 5.

UNIT-V: Independent coordinates of rigid body. , The Euler angles, Euler's theorem on theMotion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4

TEXT BOOKS : Classical Mechanics H.Goldstein (Addison-Wleley, 1st & 2nd ed)

REFERENCE BOOK: Classical Dynamics of Particles and Systems J.B.Marion.

M.Sc. Physics
I Semester

102: INTRODUCTORY QUANTUM MECHANICS

UNIT-I: The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation -Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability.

UNIT-II: Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

UNIT-III: One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of L2, LZ , L + and L_ operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

UNIT-IV: Time- independent perturbation theory for**(i)** non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

UNIT-V: Degenerate systems, application to linear stark effect in Hydrogen. Variation method and its application to Helium atom. Exchange energy and low lying excited states of Helium atom. Interaction of electromagnetic radiation with matter. Selection rules.

Text Book :

Quantum Mechanics R.D. RATNA RAJU

Reference Books :

1. Quantum Mechanics Aruldhas
2. Quantum Mechanics G. S. Chaddha
3. Quantum Mechanics B.H.Bransden and C.J.Joachain
4. Quantum Mechanics E. Merzbacher
5. Quantum Mechanics Richard Liboff

M.Sc. Physics
I Semester
103: Mathematical Methods of Physics

Unit I : Complex Variables

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy's integral theorem- Cauchy's integral formulae-multiply connected region- problems, Infinite series-Taylor's theorem- Laurrent's theorem-Problems, Cauchy's Residue theorem- evaluation of definite integrals-problems.

Text Book: 1.Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3.Complex Variables (Schaum's out line series) MurrayR.Spiegel
Ref Book: Mathematical Methods B.D.Gupta

Unit II : Beta , Gamma functions &Special functions

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals
Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating finction-recurrence relations-Rodrigue's formula-orthonormal property-associated Legendre polynomial-simple recurrence relation-orthonormal property-spherical harmonics

Text Book: 1.Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3. Mathematical Physics B S Rajput
Ref book : Special Finctions .M.D.Raisinghania

Unit III : Laplace Transforms & Fourier series, Fourier Transforms

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave
Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

Text Book: 1.Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3. Laplace n Fourier Transforms Goyal & Gupta,
Ref books: Integral Transforms M.D.Raisinghanna
Integral Transforms Goyal & Gupta
Mathematical Physics B S Rajput

Unit IV: Numerical Analysis

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false positionIteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method.

Unit V: Interpolation

Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formule
Interpolation with unequal internals-Newtons divided difference formula-Lagrange interpolation formula
Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson'1/3 rule & 3/8 rule

Text Books: Introductory methods of Numerical analysis S.S.Sastry

Numerical Methods V.N.Vedamurthy &.N.Ch.S.N.Iyengar

M.Sc. Physics
I Semester

104: ELECTRONIC DEVICES AND CIRCUITS

UNIT-I

SEMICONDUCTOR DEVICES:

Tunnel diode, photo diode, solar cell, Schottky Barrier Diode, Varactor diode, Gunn Diode, PIN Diode, APD, LED.

UNIT-II

MICROWAVE DEVICES:

Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Magnetron,CFA,TWT, BWO, IMPATT, TRAPATT.

UNIT-III

TRANSISTORS

Uni Junction Transistor, Silicon controlled Rectifier, Field Effect Transistor, (JFET & MOSFET), CMOS

UNIT- IV

OPERATIONAL AMPLIFIERS :

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents, Operational Amplifier parameters- input offset voltage, input bias current , Common Mode Rejection Ratio, Slew Rate. Op- amp applications**:** Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter.

UNIT-V

OSCILLATORS

Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger

Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

TEXT BOOKS:

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy(PHI)

REFERENCE BOOKS:

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

M.Sc. Physics
I Semester

105: MODERN PHYSICS LAB - I

1.Atomic Spectrum of Zinc.
a) Verification of Lande's interval rule
b) Study of relative intensities

2.Grating spectrometer
a)Wavelengths of Hg spectrum,
b) wavelength of Balmer series, Rydberg constant

3. Reciprocal dispersion curve
4. Application of Point Groups.
a)Identification of symmetry operations in H_2O, BH_3 , NH_3 and H_2CO
b)Reducible representations and Vibrational modes of H_2O.
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor.(Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
a)conversion of given wavelengths to wavenumbers and assignment of (v', v'')
b)Deslandres' table and Vibrational constants.

M.Sc. Physics

I Semester

106: ELECTRONICS LAB -I

LIST OF EXPERIMENTS

1. FET amplifier	(BFW 10/11)
2. Negative feedback amplifier	(BC 147)
3. Colpitts Oscillator	(BF 194)
4. Phase shift Oscillator	(BC 147)
5. Astable Multivibrator	(BF 194)
6. Op.Amp.Characteristics	(IC 741)
7. Power Supply	
8. UJT Characteristics	(2 N 2646)
9. R.F.Amplifier	(BF 194)
10. Boot-strap time base generator	(2N 2222)

Dr. B.R. Ambedkar University, Srikakulam

M.Sc. Physics

II Semester

201: ELECTRO DYNAMICS.

UNIT-I: Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems. Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic inducation,

UNIT-II; Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations. Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge,

UNIT-III:

Charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogerous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields.

UNIT-IV:

Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves

UNIT-V:

Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields.

Text books:

1. Classical Electrodynamics : - J.D. Jackson
2. Introduction to Electrodynamics : - D.R. Griffiths
3. .Electromagnetic Theory and Electrodynamics - Satyaprakash
4. Electrodynamics - KL Kakani

M.Sc. Physics
II Semester
202: STATISTICAL MECHANICS

UNIT-I : Basic Methods and Results of Statistical Mechanics:

Specification of the state of a system, phase space and quantum states,
Liouvilles theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities,

UNIT-II: Ensembles

Isolated systems (Microcanonical ensemble).Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble . Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

UNIT-III: Simple Applications of Statistical Mechanics:

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

UNIT-IV: Quantum Statistics:

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

UNIT-V: Non Ideal Classical Gas:

Calculation of the partition function for low densities. Equation of state and virial coefficients (Van Der Walls equation) Reif Ch:10.3,10.4

Phase Transitions and Critical Phenomena:

Phase transitions , conditions for Phase equilibrium, First order Phase transition – the Clausius–Clayperon equation, Second order phase transition, The critical indices, Van der Waals theory of liquid gas transition. Order parameter, Landau theory. Sinha Ch:10

Text Books

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria

M.Sc. Physics

II Semester

203: ATOMIC AND MOLECULAR PHYSICS.

UNIT-I

ONE ELECTRON ATOMS : Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin . Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of Hydrogen and Fowler series of ionized Helium. Hyperfine structure of $H\alpha$ line of hydrogen ($I = ½$) .

UNIT-II

ONE VALENCE ELECTRON ATOMS: Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of ^2P-^2S of sodium (I= 3/2).

UNIT- III

MANY ELECTRON ATOMS : Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling (ss,s^2 ,pp,p^2 configurations). Exchange force and Spectral series of Helium.

Lasers- spontaneous emission, stimulated emission, population inversion, Einstein coefficients, metastable levels, resonance transfer and population inversion in He-Ne laser.

UNIT-IV

ATOMS IN EXTERNAL MAGNETIC FIELD: Quantum theory of Zeeman and Paschen-Back effects and application to ^2P-^2S, ^3P-^3S, transitions.

ATOMS IN EXTERNAL ELECTRIC FIELD: Linear stark pattern of $H\alpha$ line of hydrogen and Quadratic stark pattern of D_1 and D_2 lines of Sodium.

UNIT-V

DIATOMIC MOLECULES: Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N_2 and O_2 and their ions. Rotational spectra and the effect of isotopic substitution. Effect of nuclear spin functions on Raman rotation spectra of H_2 (Fermion) and D_2 (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

MOLECULAR VIBRATIONS : Symmetry operations and identification of point Groups of HCN, CO_2 , BH_3 , NH_3 , H_2O molecules. Properties of irreducible representations and C_{2v} character table. Reducible representation and symmetry of fundamental vibrations of H_2O

.

BOOKS :

1. Atomic and Molecular Spectra - Rajkumar
2. Fundamentals of Molecular Spectroscopy - C.N.Banwell.
3. Group Theory - K.V.Raman.
4. Introduction to Atomic Spectra - H.E.White.

M.Sc. Physics

II Semester

204: NUCLEAR AND PARTTICLE PHYSICS

UNIT - I

INTRODUCTION :

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, Energy levels, mirror nuclei.

NUCLEAR FORCES : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, charge independence and charge symmetry of nuclear forces ,exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

UNIT - II

NUCLEAR MODELS . Liquid drop model:, Weissacker's semi-emperical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model., More-realistic models

NUCLEAR DECAY : Alpha decay process, Energy release in Beta-decay, Fermi's Theory of β - decay, selection rules, parity violation in β -decay, Detection and properties of neutrino, . Energetics of gamma deacay, selection rules, angular correlation, Mossbauer effect.

UNIT – III

NUCLEAR REACTIONS : Types of reactions and conservation laws, the Q – equation, Optical model, heavy ion Reactions.

NUCLEAR ENERGY Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

UNIT - IV

DETECTING NUCLEAR RADIATION: Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

ACCELERATORS: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

APPLICATIONS OF NUCLEAR PHYSICS: Trace Element Analysis, Rutherford Back-scattering, Mass spectrometry with accelerators, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

TEXT BOOKS :. "Introductory Nuclear Physics" Kenneth S. Krane

UNIT - V

ELEMENTARY PARTICLE PHYSICS: Particle interactions and families, symmetries and conservation laws (energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number(Gellmann and Nishijima formula) and charm), Elementary ideas of CP aand CPT invariance, SU(2), SU(3) multiplets, Quark model.

Reference Books:

1. "Introduction to Nuclear Physics " Harald A.Enge
2. "Concepts of Nuclear Physics " Bernard L.Cohen.
3. " Introduction to High Energy physics" D.H. Perkins
4. " Introduction to Elementary Particles" D. Griffiths

LIST OF EXPERIMENTS FOR

M.Sc. Physics
II Semester
205: MODERN PHYSICS LAB -II

1. Atomic Spectrum of Sodium.
   a) identification of sharp and diffuse doublets
   b) doublet separation
   c) assignment of principal quantum numbers
2. Raman Spectrum of Carbon Tetrachloride
   a)Raman shifts
   b) Fermi resonance
3. Vibrational analysis of AlO Green system.
   a)identification of sequences, assignment of vibrational quantum numbers,
   b) Deslandre's table and Vibrational constants.
4. Determination of Specific Charge of an electron by Thomson's Method.
5. Experments with He- Ne laser .
   a)Polarization of laser light
   b)Divergence of laser beam and monochromaticity.
6. Band gap of a semiconductor(Four probe method).
7. Dielectric constant as a function of temperature and determination of Curie Temperature
8. Susceptibility of a substance Gouy's method
9. Dissociation energy of Iodine molecule from the given data.

<u>LIST OF EXPERIMENTS FOR</u>

<u>COMMON FOR M.SC.PHYSICS AND M.Sc. SPACE PHYSICS</u>

M.Sc. Physics

II Semester

<u>206: ELECTRONICS LAB -II</u>

List of Experiments (Any SIX of the following)

1. Active Low pass and High Pass filters (IC 741)

2.Twin -T filter (IC 741)

3. Logarithmic Amplifier (IC 741)

4. Wein Bridge Oscillator (IC 741)

5. Monostable multivibrator (IC 555)

6. Voltage Regulator (IC 723)

7. Phase Shift Oscillator (IC 741)

8. Astable multivibrator (IC 555)

9.Active band pass filter (IC 741)

10. Voltage controlled oscillator ((IC 741, IC 555)

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M.Sc. Physics

III Semester

301: SOLID SATE PHYSICS.

UNIT-I: CRYSTAL STRUCTURE:

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE:

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical StructureFactor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

UNIT-III: PHONONS AND LATTICE VIBRATIONS:

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

FREE ELECTRON FERMI GAS:

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields-Hall effect, Ratio of thermal to electrical conductivity.

UNIT-IV: THE BAND THEORY OF SOLIDS:

Nearly free electron model, Origin of the energy gap, The Block Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbitals in a band--metals and isolators. The distinction between metals, insulators and semiconductors.

UNIT-V: FERMI SURFACES OF METALS:

Reduced zone scheme, Periodic Zone schemes, Construction of Fermi surfaces, Electron orbits, hole orbits and open orbits, Experimental methods in Fermi surface studies-- Quantization of orbits in a magnetic field, De-Hass-van Alphen Effect, extremal orbits, Fermi surface of Copper.

TEXT BOOKS:

1.Introdcution to Solid State Physics, C.Kittel, 5th edition,

2.Solid State Physics, A.J.DEKKER.

M.Sc. Physics
III Semester

302: Lasers and Fiber Optics

UNIT-I

LASER SYSTEMS : Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO_2 Laser, Dye laser, Excimer laser, Semiconductor laser.

UNIT – II:

LASER CAVITY MODES: Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes.

UNIT-III

ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

UNIT-IV

OPTICAL FIBER WAVEGUIDES : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

UNIT-V

FIBER CHARACTERISTICS : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

TEXT BOOKS**:**

1. **Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)**
2. Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)

REFERENCE BOOKS:

1. Laser fundamentals – William T. Silfvast (Cambridge)
2. Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)
3. Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)
4. Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)

M.Sc. Physics
III Semester
303: Digital Electronics & Microprocessors

UNIT - I

Digital Circuits (i) Number Systems and Codes: Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code.(ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan laws.
II) Combinational Logic Circuits: (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.
(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder.(iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

UNIT - II
Sequential Logic Circuits:(i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops.(ii) Counters: Asynchronous counters (Ripple), Counters with MOD number $< 2^N$, Asynchronous down counter, Synchronous counters, Up-down counter, Presettable counter.
(iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO
(iv) Applications of Counters: Frequency Counter and Digital clock.

UNIT - III
A/D and D/A Converter Circuits: D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

UNIT - IV
Intel 8085 Microprocessor:
Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle.
Programming the 8085 Microprocessor:
(i) Addressing Methods, Instruction set, Assembly language programming.
(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.
(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

UNIT - V

Data Transfer Technique:

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

8085 Interfacing:

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

TEXT & REFERENCE BOOKS:

1. "Digital Systems – Principles and applications" –Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.

M.Sc. Physics

III Semester

304: RADAR SYSTEMS & SATELLITE COMMUNICATION

UNIT - I

Radar Systems:

Fundamental – A simple RADAR – overview of frequencies – Antenna gain Radar Equation – Accuracy and Resolution – Integration time and the Doppler shift (Ch 1 of Text Book 1)

Designing a surveillance radar – Rader and surveillance – Antenna beam – width consideration – pulse repetition frequency – unambiguous range and velocity – pulse length and sampling – radar cross section – clutter noise (Ch 2 of Text Book 1)

UNIT - II

Tracking Radar – Sequential lobbing – conial scanning – Monopoles Radar – Tracking accuracy and Process – Frequency Agility – Radar guidance (Ch3 of Text Book 1)

Signal and Data Processing – Properties of clutter – Moving Target Indicator Processing Shareholding – Plot extraction – Tract Association, Initiation and Tracking (Ch 5 of Text Book 1)

UNIT – III

Radar Antenna – Antenna parameters – Antenna Radiation Pattern and aperture distribution – Parabolic reflector – cosecant squared antenna pattern – effect of errors on radiation pattern – Stabilization of antennas (Ch7 of Text Book 2).

UNIT - IV

Satellite Communication

Satellite System – Historical development of satellites – communication satellite systems – communication satellites – orbiting satellites – satellite frequency bands – satellite multiple access formats (Ch1 of Text Book 3).

Satellite orbits and inclination – Look angles, orbital perturbations, space craft and its subsystems – attitude and orbit control system – Telemetry, Tracking and Command – Power system – Transponder – Reliability and space qualification – launch vehicles

(Ch2 & 3 of Text Book 4)

UNIT - V

Multiple Access Techniques – Time division multiple access – Frequency division multiple access – Code division multiple access – Space domain multiple access (Ch 7 of Text Book 4).

Earth Station technology – Subsystem of an earth station – Transmitter – Receiver Tracking and pointing – Small earth station – different types of earth stations – Frequency coordination – Basic principles of special communication satellites – INMARSAT VSAT, GPS, RADARSAT, INTELST

(Ch 10 & 11 of Text Book 4).

Text Books:

1. Understanding Radar Systems – Simon Kingsley and Shaun Quegan.
2. Introduction to Radar Systems – MI Skolnik
3. Satellite Communication – Robert M. Gagliardi
4. Satellite Communication – Manojit Mitra

M.Sc. Physics
III Semester

305 : DIGITAL ELECTONICS Lab

I Digital electronics

1. Verification of Gates: AND, OR, NOT, NAND, NOR, EX –OR, EX – NOR gates

2.   Encoder and Decoder

3   Multiplexer and De multiplexer

4. Adders: Half adder, Full Adder, Paraller Adder

5. Flip Flops (7400,7402,7408,7446)

6 Decade Counter (IC 7490)

7. Seven segment Decoder/ Driver (7490,7447)

8 .UP/DOWN Counter   IC 74193

9. Digital Comparator (7485)

10 Micrprocessor 8085

Addition/ subtraction of 8 bit numbers

Sum of series of 8 – bit numbers

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M.Sc. Physics

IV Semester

401: ADVANCED QUANTUM MECHANICS .

UNIT - I

Linear Vector Spaces in Quantum Mechanics:

Vectors and operators, change of basis, Dirac's bra and ket notations. Eigen value problem for operators. The continuous spectrum. Application to wave mechanics in one dimension.

(Merzbacher Sec. 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7)

UNIT - II

Quantum Dynamics :

The equation of motion, Quantization postulates, canonical quantization, Constants of motion and invariance properties. Heisenberg picture. Harmonic Oscillator.

(Merzbacher . Sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7)

UNIT - III

Development of time-dependent perturbation theory. The golden rule for constant transistion rates.

(Merzbacher. Chapter. 18 relevent parts)

Addition of two angular momenta. Tensor operators.

Wigner-Eckart theorem. Matrix elements of vector operators. Parity and time reversal symmetries.

(Merzbacher . Section. 16.6, 16.8, 16.10, 16.11)

UNIT - IV

Scattering:

Concept of differential cross-section. Scattering of a wave packet. Born approximation. Partial waves and phase shift analysis.

(Merzbacher. Section. 11.1, 11.2, 11.4, 11.5)

UNIT - V

Relativistic Quantum Mechanics

Klein – Gordon equation, Dirac equation for a free particle, Equation of continuity, Spin of a Dirac particle, Solutions of free particle Dirac equation, Negative energy states and hole theory

TEXT BOOKS:

1. " Quantum Mechanics" by R.D. Ratna Raju
2. "Quantum Mechanics " by E. Merzbacher

Reference Books:

1. " Quantum Mechanics" by Thankappan
2. "Quantum Mechanics" by Biswas

M.Sc. Physics

IV SEMESTER

402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS

UNIT - I

THERMAL PROPERTIES:

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

OPTICAL PROPERTIES :

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

UNIT - II

MICROSCOPIC EXAMINATION:

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

UNIT - III

RESONANCE METHODS:

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin- spin relation, spin-lattice relaxation, Electron Spin Resonance: Introduction, g-factor, experimental methods.

UNIT - IV

NUCLEAR MAGNETIC RESONANCE

Equations of motion, line width, motional narrowing, hyperfine splitting, Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

UNIT - V

5ELECTRICAL AND MAGENTIC CHARACTERIZATION TECHNIQUES:

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

OPTICAL SPECTROSCOPY:

Fundamentals of Infra-red Spectroscopy and Applications.

TEXT BOOKS:

Solid State Physics, 5^{th} edition, C.Kittel

Fundamentals of Molecular Spectroscopy CN Banwell

Mossbauer Effect and its Applications VG Bhide

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M.Sc. Physics
IV SEMESTER
403 : COMMUNICATION ELECTRONICS

UNIT- I. CW Modulation:

Amplitude Modulation (AM): Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band , suppressed carrier (DSBSC) Modulation, Super heterodyne receiver. Single Side Band Modulation (SSB):SSB principles, Balanced Modulator, SSB generation. Angle Modulation

UNIT-II

Frequency modulation (FM): sinusoidal FM, Frequency spectrum for sinusoidal FM frequency deviation, modulation index, Average power in sinusoidal FM, FM generation
Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

UNIT-III. Pulse Modulation:

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI , HDBn and Manchester codes, M-ary encoding, Differential encoding
Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation(PTM) ,Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation(DM) .
Digital Carrier Systems:

UNIT-IV. Special Communication Circuits :

Tuned amplifiers :Single tuned amplifier-Hybrid π – equivalent for the BJT, Short circuit current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.
Mixer Circuits : Diode mixer, IC balanced mixer.
Filters : Active filters, Ceramic, Mechanical and crystal filters.
Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop(PLL).

UNIT-V. Noise in Communication Systems:

Thermal Noise, Shot Noise, Partition noise, Signal - to – Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI), eye diagr**ams.**

Text Books:

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

M.Sc. Physics

IV Semester

404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION

UNIT – I: Radiation

Potential functions of electro magnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation. *(Chapter 10 in Jordan and Balmain* .Antenna Fundamentals Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas.
(Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus)

UNIT – II: Antenna Arrays

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization. *(Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus)*

UNIT – III: Impedance

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconcal antenna and its impedance.
(Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus)

UNIT – IV: Frequency Independent (FI) Antennas

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures.
(Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus)
Methods of excitation and Practical Antennas
Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna. Complementary screens and slot antennas. Radiation from a rectangular horn antenna.
(Chapter11.15 in Jordan and Balmain and Chapters 6.1 – 6.4 ,7.1 – 7.8 and 13 in Kraus)

UNIT –V: Radio Wave Propagation

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance.
(Chapter 16 and 17 in Jordan and Balmain)

BOOKS

1.”Electromagnetic waves and Radiating Systems” by E.C.Jordan and K.G.Balmain
2.”Antennas” by J.D.Kraus. (Second Edition)

M.Sc. Physics

IV SEMESTER

405 : MICROPROCESSOR LAB

1.Decimal addition of 8 – bit numbers

2 Addition of two 16 – bit numbers

3 Multibyte addition

4.Sum of series of 16 – bit numbers

5.Word Disaasembly

6. Largest number in an array

7. Ascending order of array of 8 - bit number

8. Interfacing of 8255 PPI: generation of square wave and rectangular waves

9. Interfacing of 8253 programmble timer: Mode 1, Mode2, Mode3, Mode 4, Mode5

10 0800 DAC interfacing : generation of square, triangular and stair case wave forms

M.Sc. Physics
IV SEMESTER

406 : COMMUNICATION LAB
LIST OF EXPERIMENTS

1. AMPLITUDE MODULATION
2. FREQUENCY MODULATION AND DETECTION
3. MIXER
4. BUTTERWORTH FIRST ORDER LOWPASS AND HIGHPASS FILTERS
5. CHEBYSHEV SECOND ORDER LOWPASS FILTER
6. PHASE LOCKED LOOP (PLL)
7. PULSE MODULATION-PAM-AND SAMPLING
8. STUDY OF PRE- EMPHASIS AND DE- EMPHASIS CIRCUITS
9. GENERATION OF PWAM, AND PPM USINGPLL AND 555 TIMER
10. STUDY OF FSK TRANSMISSION AND RECEPTION
11. OPTICAL FIBRE –BENDING LOSSES AND NUMERICAL APERTURE
12. MEASUREMENT OF BIT ERROR RATE (BER)
13. MEASUREMENT OF SPEED OF LIGHT IN OPTICAL FIBRE
14. DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN $TE_{1,0}$
15. DETERMINMATION OF STANDING WAVE RATIO AT REFLECTION COEFFICIENT
16. STUDY OF ISOLATOR /CIRCULATOR

17. MEASUREMENT OF GAIN , FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN IN HALF WAVE DIPOLE

18.FIVE ELEMENT YAGI UDA ANTENNA

19.HELICAL ANTENNA

20.CUT –PARABOIDAL REFLECTOR ANTENNA

MODEL QUESTION PAPER

M.A /M.Sc/M.Com/MCA/MLISc/M.Ed/B.Ed(MR)/DEGREE EXAMINATIONS

COURSE IN: ____________________________________

SEMESTER_____________________

PAPER No._________ & TITLE: ____

TIME: 3 Hrs **Max Marks: 85**

SECTION – A

Question No.1 is Compulsory

Answer ALL questions

Each answer shall not exceed one page or 200 words

1. **(5 x 5 = 25)**

A.
B.
C.
D.
E.

SECTION – B

Answer ALL questions

Each answer shall not exceed five page or 1000 words

(5 x 12 = 60)

UNIT-I

2.

Or

3.

UNIT-II

4.

Or

5.

UNIT-III

6.

Or

7.

UNIT-IV

8.

Or

9.

UNIT-V

10.

Or

11.