Department Of Physics
Osmania University

Scheme of Instruction and Syllabus

M.Sc (Physics)

I, II, III and IV Semesters
under CBCS scheme

(W.e.f academic year 2018-2019)

G.Pulla Reddy Degree & PG College, Hyderabad

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD

M. Sc. (Physics) and M.Sc. (Appl. Electronics) Courses under CBCS
(With effect from the academic year 2018 –2019)

Semester – I

S.no.	Sub. Code	Paper No.	Subject	Instructions. Hrs/week	Credits	Max. Marks
THEORY						
01	PAE 101T	I	Mathematical Physics	4	4	100*
02	PAE 102T	II	Classical Mechanics	4	4	100*
03	PAE 103T	III	Quantum Mechanics - I	4	4	100*
04	PAE 104T	IV	General Solid State Physics	4	4	100*
PRACTICALS						
05	PAE 151P+ 152P	V & VI	C – Programming lab – I & Electronics lab - I	8	4	100
06	PAE 153P +154P	VII & VIII	Heat & Acoustics lab – I & Optics lab - I	8	4	100
			Total:		24	600

*** Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for University exam. Common Syllabus to University, Constituent Colleges and Affiliated Colleges. There shall be no internal assessment examinations for practicals. Practical Examinations will be conducted at the end of each semester.**

Pattern of Question Paper: The question paper consists of two parts, each covering all the **four units**. Part –A consists of EIGHT short answer questions, carrying 4 marks each. The student has to answer all the questions. Part –B consists of FOUR essay type questions with an internal choice. Each question carries 12 marks.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- I Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 101 T **Paper –I :: Mathematical Physics**

UNIT –I: (13 Hrs**)**
Linear Differential equations with variable coeffcients:
Legendre's Differential equation: The Power series Solution–Legendre Functions of the first and second kind –Generating Function- Rodrigue's formula– Orthogonal Properties – Recurrence Relations.
Bessel's Differential Equation: Power series Solution –Bessel Functions of First and Second kind- Generating Function –Orthogonal Properties –Recurrence Relations. Beta and Gamma functions – Properties and their relations .

UNIT –II: (13 Hrs**)**
Hermite Differential Equation : Power series Solution–Hermite polynomials – Generating Function-Orthogonality –Recurrence relations -Rodrigues formula.
Laguerre Differential equations: The Power series Solution–Generating Function-Rodrigue's formula– Recurrence Relations, Orthogonal Properties- Integral representation of Laguerre differential equtions

UNIT –III : (13 Hrs**)**
Fourier Transform : Infinite Fourier Sine and Cosine transforms–Properties of Fourier transforms-Derivative of Fourier transform –Fourier transform of a derivative-Fourier Sine and Cosine transform of derivatives-Finite Fourier transforms – Applications of Fourier Transforms.
Laplace Transform: Properties of Laplace transforms **–**Derivative of Laplace transform– Laplace transform of a derivative –Laplace transform of periodic functions-Inverse Laplace transform and its properties –Inverse Laplace theorem –Convolution theorem.
Unit –IV : (13 Hrs**)**
Matrices– eigen values- eigen vectors -Characteristic equation of a matrix- Cayley Hamilton theorem- Types of matrices- symmetric and skew symmetric and Hermitian matrices- Unitary and symmetry transformations
Tensors –Order and rank of the tensors –transformation laws of covariant, contra-variant and mixed tensors – properties of tensors: Addition, subtraction and multiplication of tensors, Outer and inner products- contraction of tensors and quotient law.

G.Pulla Reddy Degree & PG College, Hyderabad

Recommended Books:

1. Applied Mathematics for Engineers and Physicists –Louis A Pipes and Lawrence R. Harvill.
2. Mathematical Physics –AK Ghatak, IC Goyal and SL Chua-Macmillan India Ltd.
3. Vector and Tensor Analysis –Schaum Series.
4. Mathematical Physics –SatyaPrakash

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- I Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 102 T **Paper –II : CLASSICAL MECHANICS**

UNIT –I : (13 Hrs**)**
Newtonian formalism : Inertial frames and Galilean transforms-Non-inertial frames-pseudo forces, rotational frames, rotational transforms and conservation theorems. Description of rotations in terms of Euler angles-Euler's equations of motion for a rigid body. Minkowski space, space-time diagrams, world point and world line-relativistic motion and Lorentz transforms as rotations in four-space, four velocity, energy-momentum vectors with few examples.

UNIT –II : (13 Hrs**)**
Lagrangian formalism : Constraints, generalized coordinates, Principle of virtual work, Lagrange's equations and applications, D'Alembert's principle, Lagrangian equations of motion for plane and spherical pendulums, L-C circuit; velocity dependent potentials-Lagrangian for a charged particle in electromagnetic field, Euler's equations from Lagrange equations. Hamilton's principle, Lagranges equations from Hamilton's principle.

UNIT –III : (13 Hrs**)**
Hamiltonian formalism : The Principle of Least Action–Applications of Hamiltons equations - motion of a particle in a central force field, projectile motion of a body. Cyclic coordinates and conservation theorems, Canonical coordinates and canonical transformations, Conditions for a transformation to be canonical, generating functions, Lagrange and Poisson brackets. Hamilton s quations in Poisson bracket from, Hamilton-Jacobi theory.

UNIT –IV : (13 Hrs**)**
Mechanics of continuous systems : Analysis of the free vibrations of a linear triatomic molecule, Eigen value equation- Principal axis transformation-Frequencies and normal coordinates Lagrangian formulation for continuous systems, Hamiltonian formulation.

Reference Books :

1. Classical Mechanics : By Goldstein, Poole &Safko (Pearson 2002)
2. Classical Mechanics :By JC Upadhyaya (Himalaya Publishing House)
3. Introduction to Classical Mechanics : Takwale&Puranik (TMH)
4. Classical Mechanics :Rana&Joag (TMH)
5. Classical Mechanics of Particles and Rigid Bodies :Kiran C Gupta. (New Age International Publishers)
6. Lagrangian and Hamiltonian Mechanics: Calkin (Allied Publishers 2000)
7. Lagrangian Dynamics : D.A. Wells (Schaum's series 1967)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- I Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 103 T **Paper –III :: Quantum Mechanics- I**

UNIT –I (13 hrs) :

Basics of Quantum Mechanics : Linear Vector space, Dirac's Ket and Bra notation. Eigenvalue equation, Eigenkets and Eigenvalues – Degenerate and non-degenerate states - completeness relation, Wave functions in position and momentum space. Normalization and Orthogonality of wave functions, change of basis. Observables - Operators, Hermitian operators and their properties-Commuting and non-commuting operators, Physical significance. Matrix representations of vectors and operators – Observable and expectation value of an observable - Parity operator, Projection operator and significance. Basic commutation relations. Uncertainty principle between any two non-commuting Operators.

UNIT –II (13 hrs) :

Exactly Solvable problems : The Schrodinger, Heisenberg picture and interaction pictures. Linear harmonic oscillator-Solution to Schrodinger equation, Eigen values and Eigen functions, properties of stationary states. Linear harmonic oscillator- Solution by operator method. Raising and Lowering operators, the number operator. Hydrogen atom, solution of the radial part of the Schrodinger equation.

UNIT –III (13 hrs) :

Symmetries in Quantum Mechanics : Discrete and continuous symmetries Noether's theorem - Space and time displacements –unitary operators of space and time displacements and equations of motion. Generators of infinitesimal rotations. Space inversion and unitary inversion operator - intrinsic parity. Time reversal operator –anti-linear operator- time reversal operator for spin zero and non- zero spin particles. SO(3) and SU(2) symmetries.

UNIT –IV (13 hrs) :

Angular Momentum : Orbital Angular Momentum, Commutation Relations involving : $\mathbf{L}^2$, L_x, L_y, L_z –Eigenvalues and Eigen functions of $\mathbf{L}^2$ –Generalized angular momentum, **J** – commutation relations between J^2 and components of **J**. J_+ and J_- Eigen values of $\mathbf{J}^2$ and J_z. Matrix representation for J^2 and J_z. Spin angular momentum-Pauli spin matrices and their properties. Addition of angular momenta - Clebsch-Gordon coefficients- Recursion relations-C-G coefficients for $J_1 = ½$, $J_2 = ½$, and $J_1 = ½$, $J_2 = 1$, as examples.

Reference Books :

1. Quantum Mechanics by L.I. Schiff
2. A Text book Quantum Mechanics : PM Mathews and K Venkateshan (TMH)
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillan)
4. Quantum Mechanics by E Merzbacher (John Wiley)
5. Quantum Mechanics by Aruldhas (New Age International)
6. Modern Quantum Mechanics by Sakurai (Addison Wesley)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- I Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 104 T **Paper – IV :: General Solid State Physics**

UNIT – I : (13 Hrs**)**
Crystalline State & Structural Studies : Crystal translational vectors, unit cell, Bravais lattices, Crystal system, Miller indices, Symmetry operations, Point groups, Space groups and their notation. Crystal structures of fcc, bcc, hcp, CsCl, NaCl, ZnS and Diamond. Bragg's law, Atomic structure factor, Geometrical structure factor and Debye Wallar factor, Concept of reciprocal lattice, Concept of Brillouin zones, Experimental methods of X-ray diffraction of crystals – Laue and Powder methods, Determination of unit cell parameters of a cubic crystal, Elements of neutron and electron diffraction.

UNIT – II : (13 Hrs**)**
Lattice Vibrations and Thermal Properties : Elastic waves in one dimensional array of identical atoms, Vibrational modes of a diatomic linear lattice and dispersion relations, Acoustic and Optical modes, Infrared absorption in ionic crystals, Phonons and verification of dispersion relation in crystal lattices. Lattice heat capacity- Einstein and Debye theories, Lattice thermal conductivity –Phonon mean free path, Origin of thermal expansion and Grunceisen relation.

UNIT – III : (13 Hrs**)**
Band Theory and Semiconductor Physics : Failure of Free electron theory of metals, Bloch theorem, Behavior of electron in periodic potentials, Kronig- Penny model, E vs K relation, Density of states in a band, Effective mass of electron, Negative effective mass and concept of hole. Distinction between metals, Semiconductors and Insulators, Intrinsic semiconductors, Fermi level, Expressions for electron and hole concentrations in intrinsic and extrinsic semiconductors, Hall effect in semiconductors.

UNIT – IV : (13 Hrs**)**
Crystal Growth and Imperfections : Crystal growth from solution and melt, growth from vapour phase, Experimental techniques of growth from melt. Classification of imperfections, Schottky and Frenkel defects, expression for their equilibrium concentrations in metals and ionic crystals, Colour centers and their models, Diffusion mechanisms, Fick's laws of diffusion, Kirkendal effect, Ionic conductivity, Dislocations- Edge and Screw dislocations, Dislocation multiplication, Grain boundaries.

Reference Books. :

1. Crystallography and Solid State Physics – A.R. Verma and O.N. Srivastava
2. Solid State Physics – A.J. Decker, Macmillian Indian Ltd, 2003.
3. Introduction to Solid State Physics – C. Kittel, John Wiley Sons Inc, New York
4. Solid State Physics- RL Singhal, KedarNath&Ramnath& Co, 2006
5. Elements of Solid State Physics – J.P. Srivastava, Prentice Hall India, 2006.
6. Elements of Solid State Physics -- Ali Omar, Pearson Education Inc, 2002.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD

M. Sc. (Physics) Courses under CBCS

(With effect from the academic year 2018 –2019)

M.Sc. :: Computer Programming Laboratory

PAE 151 P + 251 P

LIST OF EXPERIMENTS :

1. Write a 'C' Programme to generate Exponent Series
2. Write a 'C' Programme to generate Sine Series
3. Write a 'C' Programme to generate Cosine Series
4. Write a 'C' Programme to implement Bisection Method
5. Write a 'C' Programme to implement Newton Raphson Method
6. Write a 'C' Programme to perform Transpose of given mxn Matrix
7. Write a 'C' Programme to perform Matrix Multiplication
8. Write a 'C' Programme to perform Least Square Fitting
9. Write a 'C' Programme to generate Finite Difference Table
10. Write a 'C' Programme to implement Euler's Method
11. Write a 'C' Programme to implement Runge-kutta 2^{nd} Order Method
12. Write a 'C' Programme to implement Runge- kutta 4^{th} Order Method
13. Write a 'C' Programme to implement Trapezoidal Rule
14. Write a 'C' Programme to implement Simpson's $1/3^{rd}$ Rule
15. Write a 'C' Programme to implement Simpson's $3/8^{th}$ Rule

Note :: Each student has to perform minimum six experiments in I semester and also in II Semester and experiment should not be repeated.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD
M. Sc. (Physics) Courses under CBCS
(With effect from the academic year 2018 –2019)

M.Sc. :: Electronics Laboratory

PAE 152 P + 252 P

LIST OF EXPERIMENTS :

ANALOG :

1. RC-COUPLED AMPLIFIER (SINGLE - STAGE)
2. SQUARE WAVE GENERATOR (IC - 741)
3. WEIN-BRIDGE OSCILLATOR (IC - 741)
4. ASTABLE MULTIVIBRATOR (IC - 555)
5. REGULATED POWER SUPPLY (IC – 78 XX)
6. VOLTAGE CONTROLLED OSCILLATOR (IC - 555)
7. INTEGRATOR (IC - 741)
8. SCHMITT TRIGGER/ZERO CROSS DETECTOR
9. RC PHASE SHIFT OSCILLATOR (IC - 741)
10. UJT (RELAXATION OCILLATOR)

DIGITAL :

11. CONSTRUCTION AND VERIFICATION OF
    a.) LOGIC GATES/CIRCUITS (USING NAND GATES 7400)
    b.) AND, OR, NOT, NOR, NAND, EX-OR
12. HALF – ADDER & FULL ADDER
13. FLIP – FLOPS : D- TYPE, T-TYPE, J K- FLIP FLOP (IC - 7496)
14. PEAKING AMPLIFIER
15. LOGARITHMIC AMPLIFIER
16. COLPITT OSCILLATOR

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD

M. Sc. (Physics) Courses under CBCS

(With effect from the academic year 2018 –2019)

M.Sc. :: Heat and Acoustics Laboratory

PAE 153 P + 253 P

LIST OF EXPERIMENTS :

1. Stefan's constant
2. Characteristics of a Thermistor
3. Specific Heat of Graphite
4. Linear Expansion of the give Material
5. Estimation of Errors
6. Ultrasonic Velocity of a liquid by Interferometer
7. Ultrasonic Velocity of water by Debye-Sear's Method
8. Ultrasonic Velocity of kerosene by Debye-Sear's Method
9. Viscosity of Water by oscillating disc method
10. Viscosity of castor oil by oscillating disc method
11. Young's Modulus Y of the material of the spiral spring
12. Rigidity Modulus of the material of the spiral spring
13. Determination of adiabatic compressibility of organic liquids using Ultrasonic interferometer
14. Thermal diffusivity of the given material

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD

M. Sc. (Physics) Courses under CBCS

(With effect from the academic year 2018 –2019)

M.Sc. :: Optics Laboratory

PAE 154 P + 254 P

LIST OF EXPERIMENTS :

1. Determination of Cauchy's Constants
2. Determination of wavelength of Na light using a diffraction grating
3. Double refraction
4. Banded spectrum
5. Newton's rings – determination of Poisson's ratio
6. Fresnel Biprism – determination of wavelength of Na light
7. Malus law
8. Michelson's interferometer
9. Single slit diffraction
10. Double slit diffraction
11. Determination of wavelength of laser
12. Thickness of thin film using Fresnel biprism or Michelson interferometer
13. Fibre Optics : Characteristics of LED and Phototransistor
14. Fibre optics: determination of numerical aperture

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY, HYDERABAD

M. Sc. (Physics) Courses under CBCS
(With effect from the academic year 2018 –2019)

Semester – II

S.no.	Sub. Code	Paper No.	Subject	Instructions. Hrs/week	Credits	Max. Marks
THEORY						
01	PAE 201T	I	Electromagnetic Theory	4	4	100*
02	PAE 202T	II	Statistical Mechanics	4	4	100*
03	PAE 203T	III	Quantum Mechanics - II	4	4	100*
04	PAE 204T	IV	Electronics	4	4	100*
PRACTICALS						
05	PAE 151P+ 152P	V & VI	C – Programming lab – I & Electronics lab - I	8	4	100
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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- II Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 201 T Paper – I :: Electromagnetic Theory

UNIT – I : (13 Hrs**)**
Electro-Static Potentials and Maxwell's Field Equations : Special techniques for calculating electrostatic potential : Poisson's and Laplace's equations- Solutions of Laplace's equations for electrostatic potential in Cartesian, spherical and cylindrical coordinates-Multi-pole expansion of the energy of a system of charges in an electrostatic field-The scalar and vector magnetic potentials. Derivation of Maxwell's equations-General wave equation-Gauge transformations-Lorentz and Coulomb gauges-Momentum, angular momentum and free energies of electromagnetic field-Poynting Theorem (work energy theorem in electrodynamics).

UNIT – II: (13 Hrs**)**
Propagation of Plane Electromagnetic Waves: Electromagnetic (EM) waves in unbounded media-EM wave equation for a homogeneous isotropic dielectric medium-Propagation of plan EM waves in free space-Propagation of EM waves in homogeneous isotropic dielectric medium- Energy transmitted by a plane EM wave-Propagation of EM wave in conducting medium- Attenuation and Skin effect-Energy transmitted – Polarization of EM wave.

UNIT – III: (13 Hrs**)**
Interaction of Electromagnetic Waves with Matter : Propagation of EM waves in bounded media-Boundary conditions for **E,D,B** and **H** – Reflection and Refraction of plane EM waves at plane interface between two dielectrics- Laws of reflection and refraction-Fresnel's relations- Reflection (R) and Transmission(T) coefficients - Brewster's angle-Total internal reflection-Reflection and Refraction of plane EM waves at plane interface between non-conducting and conducting medium-Metallic reflection and its applications – Dispersion in non-conductors –Normal and anomalous dispersion.

UNIT – IV: (13 Hrs**)**
Electromagnetic Fields and Radiating Systems: Electromagnetic radiation: Inhomogeneous wave equation for potentials-Retarded potentials-Multipole expansion of EM radiation for harmonically oscillating source-Long wavelength approximation-Oscillating electric dipole radiation-Oscillating magnetic dipole radiation-Radiation from center-fed linear antenna. Radiation from accelerated charges : Lienard-Wiechert potentials-Electromagnetic field of a charge in arbitrary motion.

Reference Books:

1. Classical Electrodynamics by SP Puri, Tata McGraw-Hill Publishing Co., Ltd (2000).
2. Introduction to Electrodynamics by DJ Griffiths, Prentice- Hall of India (1998).
3. Electricity and Magnetism by MH Nayfeh and MK Brussel, John Wiley and Sons (1985).
4. Classical Electrodynamics by JD Jackson, John Wiley and Sons (1999).
5. Foundations of Electromagnetic Theory by JR Rietz, FJ Milford and Christy, Narosa Publishing house (1986)
6. Engineering Electromagnetics by WH Hayt and JA Buck Tata Mc-Graw Hill (2001)
7. Electromagnetic waves and Radiating systems by EC Jordan and KG Balmain, Prentice Hall (1968)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- II Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 202 T **Paper – II :: Statistical Mechanics**

UNIT – I : (13 Hrs**)**

Relation between thermodynamics and statistical mechanics- Micro states and macro states of a system – Phase space- Ensembles – Mean values and ensemble average – Density distribution in phase space- Liouville's theorem. Apriori probability postulate – Micro canonical, canonical and grand canonical ensembles –Quantization of phase space. Entropy and Probability –Equilibrium conditions: Thermal, mechanical and quasi static equilibrium. Entropy of a perfect gas using micro canonical ensemble-Gibbs paradox-Sackur.-Tetrode equation.

UNIT – II : (13 Hrs**)**

Maxwell –Boltzmann statistics-Distribution law- Maxwell velocity distribution-Equipartition theorem. Canonical ensemble- Partition function-Ideal gas, Grand canonical ensemble-Partition function-Ideal gas .Quantum Statistical Mechanics-Postulates-Indistinguishability-Bose-Einstein and Fermi-Dirac statistics and distribution laws.

Partition function and thermodynamic quantities-Translational, rotational and vibrational partition functions - Specific heat of diatomic molecules.

UNIT – III : (13 Hrs**)**

Ideal Bose-Einstein gas-Energy and pressure of the gas. Bose-Einstein condensation-Liquid Helium-Two Fluid model-Phonons, protons, super fluidity. Ideal Fermi-Dirac gas Energy and pressure of the gas –Electronic specific heat, thermionic emission, white dwarfs.

UNIT – IV : (13 Hrs**)**

Fluctuation-mean square deviation-Fluctuations in energy, volume and concentration Brownian motion-Classification of phase transition-Phase transitions of first and second kind: Ising model, Bragg-Williams approximation-One dimensional Ising model an application to Ferro magnetic systems-Order-Disorder transition.

Reference Books. :

1. Statistical Mechanics by SatyaPrakash and JP Agarwal (Pragati Prakashan-2002)
2. Statistical Mechanics by Gupta and Kumar (Pragathi Prakashan -2002)
3. Statistical Mechanics by BK Agarwal and M Eisner (New Age International)
4. Statistical Mechanics by RK Srivastava and J Ashok (Prentice Hall, India)
5. Introduction to phase transitions and critical Phenomena HE Stanley (Clarendon Press, Oxford).
6. Heat and Thermodynamics by Zemansky (TMH).

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- II Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 203 T Paper – III :: Quantum Mechanics – II

UNIT – I (13 hrs) :

Scattering Theory : Kinematics of Scattering Process: differential and total cross-section -Asymptotic form of scattering wave function. Scattering amplitude by Green's method. Born approximation method and screened Coulomb potential and square well potential as examples - Partial wave analysis and phase shift-Optical Theorem- Relationship between phase shift and Potential. Scattering by Hard sphere.

UNIT – II (13 hrs) :

Time Independent Perturbation Theory : Approximation Methods. Non-degenerate case, First-and Second- order cases - Examples of harmonic and an-harmonic Oscillators. Degenerate case- Stark effect for H-atom for n=2 level. Variation Method - Helium atom ground state. WKB approximation method - connection formulae - application to Alpha Decay.

UNIT – III (13 hrs) :

Time Dependent Perturbation Theory : Time development of state, variation of constants (coefficients), Transition probability- Selection rules for transition. Constant perturbation. Transition probability to closely spaced leaves- Fermi's golden rule. Harmonic perturbation- Transition probability rate. Interaction of an atom with electromagnetic radiation. Electric dipole approximation. The Einstein Coefficients.

UNIT – IV (13 hrs) :

Relativistic Quantum Mechanics : Klein –Gordon Equation, Plane wave solution and Equation of continuity, Probability density- Dirac Equation, alpha, beta- matrices, Plane wave solution, significance of negative energy states. Spin of Dirac particle Relativistic particle in central potential –Total Angular Momentum, Particle in a magnetic field – Spin Magnetic moment, properties of gamma matrices- Dirac's equation in covariant form.

Reference Books:

1. Quantum Mechanics by LI Schiff
2. A Text book Quantum Mechanics by PM Mathews and K Venkateshan (TMH)
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillan)
4. Quantum Mechanics by E Merzbacher (John Wiley)
5. Quantum Mechanics by Aruldhas (New Age International)
6. Modern Quantum Mechanics by Sakurai (Addison Wesley)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY,HYDERABAD
Semester- II Syllabus M.Sc. (Physics)

(w. e. f 2018 -2019 Under **CBCS)**

PAE 204 T **Paper – IV :: Electronics**

UNIT – I : (13 Hrs**)**

Regulated Power Supply : basic Principle of regulated power supply: Zener regulator and its working, Transistorized Series regulator, fixed IC voltage regulators using IC 78XX and 79XX, variable IC regulators with LM317 and LM338.

Feed back in Amplifiers: The concept of feedback, Positive and Negative feedback – feedback gain- Advantages of Negative feedback in amplifiers, Emitter follower - Darlington pair.

Oscillators : Barkhausen Criterion, RC oscillators : Phase shift Oscillator, Wein Bridge Oscillator, LC Oscillators: Hartley and Collpitts Oscillators- Crystal Oscillator.

UNIT – II : (13 Hrs**)**

Operational Amplifiers : Characteristics of Ideal operational Amplifier, Block diagram of an IC operational Amplifier, Emitter coupled differential amplifier and its transfer characteristics. Analysis of inverting amplifier, Non-inverting amplifier, Integrator, Differentiator, summing amplifier, Difference amplifier, Comparator, Logarithmic amplifier and exponential amplifier, Square wave, Rectangular wave and Triangular wave generators.

Timer IC 555: Working of IC 555, Astable and Mono-stable Multi-vibrator with IC 555.

UNIT – III : (13 Hrs**)**

Logic Circuits: Min terms and Max terms,simplification of Boolean equations- sum of products and product of sums- Karnaugh Maps (upto 4 variables), Data selector/ Multiplexer , Decoder/ De-multiplexer

Flip –Flops: RS, D, JK and M/S JK flip flops with their truth tables, timing diagrams.

Registers: Types of Registers, Serial in Serial out, Serial in Parallel out, Parallel in Serial out and Parallel in Parallel out Registers.

Counters: Asynchronous and Synchronous Counters, Modulus N Counter, Ripple Counter, Decade Counter using Flip-Flops and IC's 7490, 7493.

UNIT – IV: (13 Hrs**)**

Microprocessor: Introduction to Microprocessors –Architecture of 8085 microprocessor, Instruction set : Data transfer instructions, Arithmetic Logic and Branch operations, Interrupts, Simple Assembly language programming : 8-bit addition, 8-bit subtraction, 8-bit multiplication, Ascending and descending arrangement of given numbers.

Reference Books. :

1. Integrated Electronics –Millman and Halkias.
2. Microelectronics –Millman & Grabel.
3. Digital principles and applications- Malvino and Leech
4. Operational amplifier –Gayakwad
5. Principles of Digital Electronics –Gothman
6. Digital Principles and Applications Computer Electronics –Malvino.
7. Microprocessors Architecture, Programing and Application with the 8085 / 8080 – Gaonkar
8. Pulse Digital & Switching Waveforms by Millman and Taub, TMH 2001.
9. Fundamentals of electronics by JD Ryder, Wiley.