DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY

M. Sc. (Physics) Course under CBCS
(W.e.f 2016-2017 for the batch admitted in I year from the academic year 2016 – 2017)
Scheme of Instructions and Examinations

Semester – I

Sl.No	Sub.Code	Paper No.	Subject	Instruc-tions. Hrs/Week	Credits	Duration of exam. (hours)	Max. Marks
THEORY							
01	PHY 101 T	I	Mathematical Physics and Numerical Methods	4	4	3	20+80*
02	PHY 102 T	II	Classical Mechanics	4	4	3	20+80*
03	PHY103 T	III	Solid State Physics	4	4	3	20+80*
04	PHY 104 T	IV	Electronic Devices & Circuits	4	4	3	20+80*
PRACTICALS							
05	PHY 105 P	V	(a) Heat & acoustics, (b) Optics	6	4	4	100
06	PHY 106 P	VI	(a) Electronics, (b) Computer programming	6	4	4	100
07	PHY S1		Seminar	2	1	--	25
08	ADD ON		Communicative English &Soft Skills	1.5	2	2	10+40*
			Total:	31.5	27		675

PHY- Physics, T- Theory, P- Practical, S- Seminars

*** Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for University exam. Common Syllabus to University and Constituent 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 FOUR short notes questions, carrying 5 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 15 marks.

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Scheme of Instructions and Examinations

Semester – II

Sl.No	Sub.Code	Paper No.	Subject	Instruc-tions. Hrs/Week	Credits	Duration of exam. (hours)	Max. Marks
THEORY							
01	PHY 201 T	I	Quantum Mechanics – I	4	4	3	20+80*
02	P HY202 T	II	Statistical Mechanics	4	4	3	20+80*
03	PHY 203 T	III	Electromagnetic Theory	4	4	3	20+80*
04	PHY 204 T	IV	Digital Electronics and Microprocessors	4	4	3	20+80*
PRACTICALS							
05	PHY 205 P	V	(a) Heat & acoustics, (b) Optics	6	4	4	100
06	PAE 206 P	VI	(a) Electronics, (b) Computer programming	6	4	4	100
07	ADD ON		Human Values & Ethics	1.5	2		10+40*
08	PHY S2		Seminar	2	1	--	25
			Total:	31.5	27		675

PHY- Physics, T- Theory, P- Practical, S- Seminars

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Part – A consists of FOUR short notes questions, carrying 5 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 15 marks.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY

M.Sc Physics Course under CBCS
(w.e.f academic year 2016 - 2017)

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY – NALGONDA
M.Sc (Physics) I- Semester Syllabus

PHY 101 T

Paper – I
Mathematical Physics & Numerical Methods

UNIT – I: (13 Hrs)
Legendre's Differential Equation: The Power series Solution –Legendre Functions of the first and second kind –Generating Function- Rodrigues Formula –Orthogonal Properties – Recurrence Relations. Beta and Gamma function –Properties –Relations between them.
Bessel's Differential Equation: Power series Solution –Bessel Functions of First and Second kind- Generating Function –Orthogonal Properties –Recurrence Relations.
Hermite Differential Equation: Power series Solution –Hermite polynomials - Generating Function-orthogonality –Recurrence relations -Rodrigues formula

UNIT – II: (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-Evaluation of inverse Laplace Transforms by Convolution theorem.

UNIT III :(13Hrs)
Solution of Algebraic Equations: Back substitution Gauss Elimination method, Gauss-Jordan Elimination method, Pivoting, Jacobi methods & Gauss-Seidel iterative methods Comparison of direct and iterative methods.
Root-finding Methods: Bisection method, successive bisection method, method of false position, Newton-Raphson method, Secant method, method of Successive approximations.

UNIT IV: (13 Hrs)
Interpolation and differential equations: Lagrange's Newton interpolation method, least square line fitting. Numerical differentiation, Numerical Integration (Gaussian Quadrature method, Newton-cotes Integration formula, Trapezoidal rule and Simpson's rule. Romberg rule)
Numerical methods for ordinary differential equations: Euler's method &Runge-Kutta method (second & fourth order)

Recommended Books:

1. Applied Mathematics for Engineers and Physicists –Lious A Pipes and Lawrance R. Rarvill.
2. Mathematical Physics – AK Ghatak, IC Goyal and SL Chua-Macmillan India Ltd.
3. Mathematical Physics – Satya Prakash
4. Sastry: Introductory Methods of Numerical Analysis.
5. An Introduction to Numerical Analysis by Kendall E. Atkinson.
6. Numerical Methods – E.Balaguruswamy, Tata McGraw – Hill publishing Company Limited.
7. Numerical Methods for Scientific and Engineering Computations – M.R.Jain, S.R.K Iyengar and R.K. Jain – PHI Publisher.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY - NALGONDA
M.Sc (Physics) I- Semester Syllabus

PHY 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 coordinate. Principle of virtual work and D'Alembert's principle Lagrange's equations from D'Alembert's principle- Applications of Lagrange's equations

(plane and spherical pendulums, L-C circuit), velocity dependent potential-Lagrangian for a charged particle in electromagnetic field, Euler's equations from Lagrange equations, Hamilton's principle- Lagrange equation's from Hamilton's principle.

UNIT – III: (13 Hrs**)**
Hamiltonian formalism

Principle of Least Action and Hamilton's equations – Applications of Hamilton's equations

(Motion of a particle in a central force field, projectile motion of a body). Cyclic coordinates and conservation theories, Canonical coordinates and canonical transforms, Conditions for a transformation to be canonical, generating functions, Lagrange and Poisson brackets. Hamilton equations 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 : Dave Wells (schaum series 19

DEPARTMENT OF PHYSICS
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PHY 103 T **Paper – III**

Solid State Physics

UNIT – I: (13 Hrs**)**
Crystallography and Band Theory solids: Introduction to crystal structures, atomic packing in solids, Crystal structures of fcc, bcc, hcp. Symmetry operations, Point groups, Space groups and their notation. Defects in solids.

Classical free electron theory of metals, 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.

UNIT – II: (13 Hrs**)**
Semiconductor Materials:
Semiconductor Structure – Conduction in semiconductors, Band gap, Intrinsic semiconductors, Fermi level, Expressions for electron and hole concentrations in intrinsic semiconductors, Hall effect in semiconductors.

Absorption of Light (Absorption Coefficient, Absorption Depth, Generation Rate, Types of Recombination, Radiative Band – to Band Recombination, Recombination Through Defect Levels, Auger Recombination), P-N Junction Photo Diodes, LED, Solar cell, Laser diode.

Unit III: (13 Hrs**)**

Thin Films: Advantages of Thin Films, Thin Film nucleation and growth, Thin film deposition techniques, Evaporation, sputtering, LPCVD and APCVD, plasma Enhanced, hot wire CVD, Ion assisted deposition, Thickness measurements, Electrical and Optical properties of Thin Films.

UNIT – IV: (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, 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.

Reference Books:

1. Solid State Physics – A.J. Deckker, Macmillian Indian Ltd, 2003.
2. Introduction to Solid State Physics – C. Kittel, Johan Wiley Sons Inc, New York
3. Solid State Physics- RL Singhal, KedarNath&Ramnath& Co, 2006
4. Elements of Solid State Physics – J.P. Srivastava, Prentice Hall India, 2006.
5. Elements of Solid State Physics -- Ali Omar, Pearson Education Inc, 2002.
6. Solar cells – M.A. Green (PHI)
7. Thin films by Goswami
8. Thin films by K.L.Chopra.
9. Solid State Physics – S.O.Pillai

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY - NALGONDA
M.Sc (Physics) I- Semester Syllabus

PHY 104 T **Paper – IV**

Electronic Devices & Circuits

Unit I (13 hrs)
Special purpose electronic devices: Zener diode, Tunnel diode, Varactor diode, Transistor – operating modes, transistor biasing configurations transistor as a switch, Field – Effect Transistor (FET), MOSFET and their parameters, SCR – Construction, Characteristics and controlled power rectification Uni Junction Transistor (UJT) construction, characteristics and as a relaxation oscillator.

Unit II (13 hrs)
Power supply: Transistor regulated power supply, switch mode power supply, IC voltage regulator – LM78XX, LM79XX, and LM317 series.

Amplifiers: RC Coupled CE amplifier – Frequency response, Emitter follower – frequency response, impedance measurements, Feedback topologies classifications, positive and negative feedback techniques, Advantages of negative feedback.

Oscillators: Barkhausen Criterion, Phase shift Oscillator, Wein Bridge Oscillator, Hartley and Colpitts Oscillators, Crystal Oscillator.

Unit III (13 hrs)
Operational Amplifiers: Characteristics, Open and closed loops configurations, Inverting and Non – inverting amplifiers – Voltage follower, Addition, subtraction, Differentiator, integrator, Analog computation – Solution to second order D.E. Logarithmic and Anti-log amplifiers. Waveform generators: Sine wave, square wave, and saw tooth voltage generators.
Unit IV (13 hrs)
Active Filters: Active Filters – First and second order low pass, high pass, band pass and band stop filters.
Timer Circuits: 555 timer – Astable, monostable, VCO, Schmitt trigger phase locked loop (PLL) (IC 565). Basic principles of frequency multiplications / division, analog phase detector.

Text & Reference Books:

1) Electronic Devics and circuit theory – Robert L.Boylestrad & Louis Nasheisky.
2) Integrated Electronics: Millmann & Halkies (Tata Magraw Hill)
3) Microelectronics: Millmann & Grable
4) Operational amplifiers: Ramakanth A Gaykwad(printic Hall India)
5) Semiconductor by SM Sze, Wiley (1985)
6) Introdduction to semiconductor Devices by M.S Tyagi #John wiley & sons
7) Fundamentals of electronics & applications by J.D. Ryder.

II SEMESTER SYLLABII STARTS HERE

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY - NALGONDA
M.Sc (Physics) II- Semester Syllabus

PHY 201 T **Paper – I**

Quantum Mechanics- I

UNIT – I (13 hrs): Basics of Quantum Mechanics

Linear Vector space, Dirac's Ket and Bra notation. Eigen value equation, Eigenkets and Eigen values – 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 operators method. Raising and Lowering operators, the number operator. Hydrogen atom, solution of the radial part of the Schrodinger equations.

UNIT – III (13 hrs): Angular Momentum

Orbital Angular Momentum, Commutation Relations involving : L^2, L_x, L_y, L_z – Eigen values and Eigen functions of L^2 –Generalized angular momentum, J – commutation relations between J^2 and components of J. J_+ and J_- Eigen values of 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.

Unit-IV (13 hrs): Approximation methods

Time Independent perturbation Theory- Non-degenerate-and second-order cases Fist-and second-order cases Examples of Harmonic (effect of additional ax^2 term) and an harmonic (bx^3 and CX^4 type of potentials) oscillators – Degenerate case – Stark effect for H-atom for n=2 level. – Variational Theory- basic principle – h-atom as an example using different Trial wave functions, Helium atom ground state – WKB Approximation – Connection formulae, Application to Alpha Decay.

Reference Books:

1. Quantum Mechanics by LI Schiff
2. A Text book Quantum Mechanics : PM Mathews and K Venkateshan (TMH)
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillian)
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
MAHATMA GANDHI UNIVERSITY - NALGONDA
M.Sc (Physics) II- Semester Syllabus

PHY 202 T **Paper – II**

Statistical Mechanics

UNIT – I: (13 Hrs**)**
Relation between thermodynamics and statistical mechanics- Micro stages 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 concentration 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, rotons, 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 a application to Ferro magnetic systems-Order-Disorder transition.

Reference Books:

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

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PHY 203 T **Paper – III**

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-Multipole 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 conducing medium- Attenuation and Skin effect-Energy transmitted –Polarization of EM wave.

UNIT – III: (13 Hrs**)**
Interaction of Electromagnetic Waves with Mater:
Propagation of EM waves in bounded media-Boundary conditions for EDB 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-conducing 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 centerfed linear antenna **Radiation from accelerated charges**:
LienardWiechert 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. Electrodynamics by Gupta, Kumar and Singh, PragathiPrakashan Publishing (2007).
4. Electricity and Magnetism by MH Nayfeh and MK Brussel, John Wiley and Sons (1985).
5. Classical Electrodynamics by JD Jackson, John Wiley and Sons (1999).
6. Foundations of Electromagnetic Theory by JR Rietz, FJ Milford and Christy, Narosa Publishing house (1986)
7. Engineering Electromagnetics by WH Hayt and JA Buck Tata Mc-Graw Hill (2001)
8. Electromagnetic waves and Radiating systems by EC Jordan and KG Balmain, Prentic Hall (1968

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY - NALGONDA
M.Sc (Physics) II- Semester Syllabus

PHY 204 T **Paper – IV**

Digital Electronics & Microprocessors

Unit-I (13 hrs)

Combinational Logic –Introduction to logic gates, Demerger's theorems, Boolean algebra, Boolean laws, Simplifications of Boolean expressions, Sum of Product (SOP) and Product of Sum (POS) forms, fundamental product, Min terms and Max terms. Karnaugh maps (up to 4 variables). Logic families and their performance characteristics- RTL, DTL, I^2R logic, TTL, ECL, PMOS, NMOS and CMOS logic.

Unit-II (13 hrs)

Sequential Logic: RS D, JK, MS-JK and T flip-flops, their operating principals and truth tables. Shift and control shift registers and their operations.
Counters: BCD Asynchronous counter, modulo-N counters Synchronous and ring counters. Encoders and Decoders.
Memories: RAM, ROM, PROM and EPROM

Unit-III (13 hrs)

Data converters: Digital to Analog converters (DAC) binary weigher, R-2R ladder type, Analog to digital converters (ADC), Dual slope integrated type, simultaneous type, successive approximation and counter type. Realization of A/D converter using D/A converter. Multiplexer and De Multiplexer.

Unit-IV (13 hrs)

Microprocessors: Introduction to microprocessors, Organization and Architecture of Intel 8085. Signal diagram, explanation of various functional modules of 8085.Flag Register and explanation of various flags with suitable examples, Interrupts, Stack. Instruction set: Instruction formats, addressing modes, and instruction groups of 8085, Data transfer, Arithmetic, logical, branch, I/O and machine control group.

Interfacing and programming examples: Interfacing stepper motor, traffic lights to 8085. Assembly Language Programs for sorting data, arranging data in Ascending or Descending, BCD addition.

Text and Reference books:

1. Digital Principles and Applications – A.P.Malvino and Donald P.Leach (TMH)
2. Modern Digital Electronic – R.P.Jain (TMH 3rd Edition)
3. Fundamentals of Digital circuits – A.Anand Kumar (PHI)
4. Microprocessor Architecture, Programming and applications with 8085/8086- Ramesh-S-gaonkar (Wiley Eastern Edition)
5. Microprocessor and Microcomputers – B.Ram(TMH)
6. Introduction to Microprocessor – Aditya P.Mathur (TMH)
7. Advanced Microprocessor and Peripherals –A.K.Ray and K.M. Bhurchandi.

Physics Practical's
(Heat Acoustics & Optics)
PHY 105 and 205:

Heat & Acoustics

1. Specific heat of graphite
2. Ultrasonic Velocity in the given liquid (water) media.
3. Stefan's constant.
4. y and n of the material of the given spiral spring.
5. Coefficient of linear expansion of solid (Brass / Aluminum/Copper/Iron.)
6. Viscosity of a given liquid by oscillating disc.
7. Estimation of errors. (Gaussian Curve)
8. Characteristics of a given thermostat / semiconductor
9. TEP

Optics

1. Fraun hoffer Diffraction Single – Double Slit.
2. Determination of wavelength of laser light – Transmission grating.
3. Spectrophotometer
   a) Cauchy's constants
   b) Dispersive power of the prism
4. Newton's rings
   Y & n of glass plate
5. Verification of law of mauls
6. Fiber optics experiments
   a) Determination of numerical aperture of a given optical fiber,
   b) Estimation of losses in the given Optical fiber (Bending, Coupling, losses).
   c) Optical source (LED) and optical detector (photo diode) Characteristics.
7. Determination of wavelength of sodium light – optical grating.

Physics Practical's
(Electronics and Computer Programming)
PHY 106 and 206:

Electronics (Any Ten)

1. Design & study of a Regulated power supply using IC 723.
2. Frequency response of RC coupled amplifier.
3. Design of CE Transistor amplifier
4. Study of basic operational amplifier (741), Inverting and non – inverting amplifier.
5. Construction of Astable Multivibratior with IC 741 and study its response.
6. Phase Shift Oscillator (BC 107 / LM741)
7. Wein Bridge Oscillator (BC 107 / LM741)
8. Astable Multivibrator (IC 555)
9. Schmitt Trigger (IC 741)
10. Differentiator and Integrator (IC 741)
11. Construction and verification of logic gates using TTL NAND and NOR gates.
12. Study of flip Flops (R-S, J-K and MS J-K)
13. Digital – to analog converter using R-2R ladder network.
14. Study of Voltage controlled oscillator using IC – 566.
15. Experiments with microprocessor, internal 8085.
    i) To arrange N numbers in ascending order
    ii) To write a program to add two 8 - bit

Computer Programming Lab (Any Ten)

1. Evaluation of function sin x, cos x and log x etc.
2. Evaluation of determinant of a matrix and matrix multiplication.
3. Evaluation of the values of 1st order Bessel function

Solutions of Non – Linear Equations

4. Newton – Raphson method
5. Bi-Section method

Numerical Integration

6. Trapezoidal rule
7. Simpson's 1/3rd & 3/8th rule
8. Gaussian Quadrature

Solutions of Differential Equations

9. Euler's method
10. Runge-Kutta Method
11. Making difference Table
12. Lagrange's interpolation
13. Polynomial curve fitting method.

Solutions of system of Linear Equations

14. Gauss's elimination method
15. Gauss's seidel method.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA

M. Sc. –Physics Course under CBCS (for the batch admitted in the academic year 2016 –2017 on wards)
Scheme of Instruction and Examination

Semester III

Sl. No	Sub. Code	Subject	Instruction Hrs/Week	Credits	Duration Of exam. (Hours)	Max. Marks
		THEORY				
01	PHY 301T	Nuclear Physics	4	4	3	20+80**
02	PHY 302T	Advanced Quantum Mechanics	4	4	3	20+80**
03		**Special paper–I**				
	PHY EC303T	Microwave Devises & Antenna Systems	4	4	3	20+80**
	PHY NEC 303T	Photovoltaics	4	4	3	20+80**
04		**Special paper–II**				
	PHY EC304T	Analog &Digital Transmission Techniques and Information Theory.	4	4	3	20+80**
	PHY NEC 304T	Hydrogen Energy	4	4	3	20+80**
		PRACTICALS				
05	PHY 305 P	**Modern Physics(Common to all)**	6	4	4	100
06	PHY 306 P/EC	**Electronics Communication – I**	6	4	4	100
	PHY 306 P/NCE	**Non Conventional Energy Physics-I**	6	4	4	100
07	ID/P 307 T	**Inter disciplinary Paper (students opt a paper offered by other Department)**	4	4	3	20+80**
08	PHY S3	Seminar	2	1	--	25
		Total:	34	29		725

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Pattern of Question Paper: The question paper consists of two parts, each covering all the **four units**.

Part–A consists of FOUR short answer questions, carrying 5 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 15 marks. The student has to answer all the questions.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA

M. Sc. –Physics Course under CBCS (for the batch admitted in the academic year 2016 –2017 on wards)
Scheme of Instruction and Examination

Semester IV

Sl. No	Sub. Code	Subject	Instruction Hrs/Week	Credits	Duration Of exam. (Hours)	Max. Marks
		THEORY				
01	PHY 401T	Modern Optics & Spectroscopy	4	4	3	20+80**
02	PHY 402T	Physics of Phonons & Nanomaterials	4	4	3	20+80**
03	PHY EC 403T PHY NEC 403T	**Special paper–I** Optical Fiber Communication Solar Thermal Energy	4 4	4 4	3 3	20+80** 20+80**
04	PHY EC 404T PHY NEC 404T	**Special paper–II** Satellite & Mobile Communications. Energy Conversion Systems	4 4	4 4	3 3	20+80** 20+80**
		PRACTICALS				
05	PHY 405 P	Modern Physics(Common to all)	6	4	4	100
06	PHY 406 P/EC PHY 406 P/NCE	Electronics Communication – I Non Conventional Energy Physics-I	6 6	4 4	4 4	100 100
07	ID/P 407 T	**Inter disciplinary Paper (students opt a paper offered by other Department)**	4	4	3	20+80**
08	PHY S4	Seminar	2	1	--	25
		Total:	34	29		725

****Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for University exam. 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 FOUR short answer questions, carrying 5 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 15 marks. The student has to answer all the questions.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) III – Semester Syllabus (CBCS)
(For the batch admitted from 2016-2017 onwards)

Paper – I
NUCLEAR PHYSICS
(Common for all Specializations)

PHY 301T

Unit I: Nuclear Force and Nuclear Models

Systematics of nuclear force-strength, range, charge independence; Deuteron problem and its contribution to the definition of the Nuclear force. Exchange force theories- Majoranna, Bartlett, Heisenberg and Yukawa.

The liquid drop model, the semi empirical mass formula and its applications. The Shell model, states based on square well potential and harmonic oscillator potential. Predictions-spins and parities of nuclear ground states, magnetic moments, electric quadrupole moments.

Unit II: Nuclear Decay Processes

α-decay, Gamow's theory, fine structure of α-spectrum, alpha decay, systematics, neutrino of hypothesis, Fermi's theory of β-decay, Fermi-Kurie plot, angular momentum, selection rules for β-decay, -decay, Multipole radiation, selection rules.

Unit III: Nuclear Radiation Detection:

Interaction of charged particles with matter, Bohr's theory, Bethe's formula. Range-energy relation. Stopping power. Measurements of range and stopping power. Interaction of gamma rays with matter-Photoelectric effect, Compton Effect and pair production. Gamma ray detection using gas, scintillation and solid state detectors.

Unit IV: Nuclear Reactions & Particle Physics

Classification of nuclear reactions, Kinematics and Q-value of reactions. Basic theory of direct nuclear reactions-Born approximation, stripping and pick-up reactions, characteristics, cross-sections, examples and applications. Compound nucleus formation. Theory of Fission and fusion reactions. Nuclear structure information from nuclear reactions.

Elementary Particles Classification and their Quantum Numbers (Charge, Spin, Isospinetc). Fundamental Forces, Conservation of Parity, Strangeness and Lepton and Baryon numbers, Quark model.

Recommended Books:

1. Concepts of Nuclear Physics; B.L.Cohen (TMH)
2. Introductory Nuclear Physics: Kenneth S.Krane (Wiley)
3. Nuclear and Particle Physics:Blin-Stoyle (Chapman and Hall)
4. Nuclear Physics;I.Kaplan (Narosa 2002)
5. Introductory Nuclear Physics: W.Wong
6. Introductory Nuclear Physics: S.B.Patel
7. Nuclear Physics: Tayal

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) III – Semester Syllabus
(For the batch admitted from 2016-2017 onwards)

Paper – II
ADVANCED QUANTUM MECHANICS
(Common for all Specializations)

PHY 302T

Unit- I Scattering Theory:

Kinematics of Scattering Process: differential and total cross-section -Asymptotic from of scattering wave function. Scattering amplitude by Green's method. Born approximation method and screened 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 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- III Many Electron Atom and Molecules

Thomas -Fermi atom – Self consistent method. Hartee – Fock method. Constants of motion in central field approximation-Corrections to the central field approximation. Born-Oppenheimer method-Molecular orbital theory. Valance bond theory. H_2^+ ion- Hydrogen molecule.

Unit- IV Relativistic Quantum Mechanic

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 Moment, Particle in a magnetic field – Spin Magnetic moment, properties of gamma matrices- Dirac's equation in covariant form.

Books Recommended:

1. Quantum mechanics – L.I.Shiff.
2. A Text of Quantum Mechanics-P.M.Mathews & Venkatesan.
3. Quantum Mechanics – Aruldhas.
4. Quantum Mechanics by Ghatak and Lokanathan (Macmillian)
5. Quantum Mechanics by E Merzbacher (John Wiley)
6. Modern Quantum Mechanics by Sakurai (Addison Wesley)

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) III – Semester Syllabus as per CBCS
(For the batch admitted from 2016-17 onwards)
Paper – III
MICROWAVES & ANTENNA SYSTEMS
(Electronic Communication Specializations)

PHY 303/EC T

Unit- I Introduction to Microwaves & Microwave transmission lines

Microwave characteristics-microwave bands, Transmission lines equations and solutions. Reflection coefficient and Transmission coefficient. Standing wave and Standing wave ratio. Line impedance and Admittance. Impedance matching. Microwave Coaxial Connectors.

Unit- II Microwave Waveguides

Introduction to microwave wave guides, Maxwell equations in time domain, Rectangular waveguide, solutions of wave equations in Rectangular coordinates, TE and TM Modes in rectangular waveguides. Power Transmission and Power losses in rectangular waveguide. Circular waveguides.Solutions of wave equations in cylindrical coordinates TE, TM and TEM modes in circular waveguides. Field patterns.

Unit- III Microwave Components & Microwave Sources

Microwave Components: Microwave hybrid circuits, Scattering(S) parameters or Matrix – S Matrix formulation. Waveguide Tees – E –Plane, H – Plane and Magic Tees. Hybrid Rings, Directional Couplers, Faraday rotation and its applications, Gyrator, Microwave Circulators and Microwave Isolators.

Microwave Sources: Klystron, Reentrant cavities, velocity modulation, Bunching process. Power output and Beam loading, Efficiency of Klystron. Reflex Klystron, Velocity modulation, Power output and Efficiency.

Unit- IV Antennas & Wave propagation& Internet Technologies

Antenna fundamentals, Magnetic and Electric fields. Antenna operation, Polarization, Antenna reciprocity. Basic antenna, Dipole antenna, radiation resistance, Dipole length, antenna Q and band width, Radiation pattern and Directivity, Antenna gain.V.H.F Antennas: Reflector (corner) Antennas, loop antenna.

Microwave Antennas: Parabolic reflector antenna, gain, beam width, feed methods, Horn antenna. Internet applications and How the Internet works.

Recommended Text Books:

1. Microwave Device and Circuits – Samuel Y.Liao – PHI
2. Fundamentals of Microwave Engineering – R.E.Collin
3. Antennas – J.D Kraus
4. Principles of Electronic Communication Systems – Louis E Frenzel (3rd Ed.) TMH

Reference Books

1. Microwave Integrated Circuits – K.C.Guptha
2. Electronic Communication – Dennis Rody and John Collins
3. Electronic Communication Systems – Kennedy and Devins
4. Antenna Theory –K D Prasad.

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) III – Semester Syllabus as per CBCS
(For the batch admitted from 2016-17 onwards)
Paper – IV
ANALOG & DIGITAL TRANSMISSION TECHNIQUES AND INFORMATION THEORY
(Electronic Communication Specializations)

PHY 304/EC T

Unit-I Analog signal Transmission

Need for modulation, Amplitude modulation (AM), Frequency spectrum for sinusoidal AM. Power Calculation of AM, Amplitude Modulation Systems (Linear and Non-Linear)-Suppressed Carrier Systems (DSB-SC), Single-Side band Modulation Systems (SSB). Detection of AM signals. Frequency Modulation (FM), Frequency Spectrum for Sinusoidal FM, Frequency Modulation Methods. Detection of FM waves – FM Demodulation with Discriminator. Phase Modulation (PM).

Unit-II Digital Transmission of Analog Signals

Analog to Digital, Sampling theorem, Sampling of Band pass Signal, The discrete of Fourier Transform, Pulse Amplitude Modulation (PAM), Channel Bandwidth for PAM. Natural sampling, Flat – top sampling, Signal recovery through holding. Quantization of signals, Quantization of error.Pulse Code Modulation (PCM), PCM system, Companding, Multiplexing PCM signals. Differential PCM, Delta modulation.

Unit- III Digital Modulation Techniques & information Theory

Binary Modulation Techniques: ASK, PSK, FSK and their Generation and Detection. Differential Phase Shift Keying (DPSK) Information Theory: Discrete messages, Average information, Entropy, Information rate, Shannon's theorem, Channel Capacity, Capacity of Gaussian- channel. Band width – S/N trade off. Use of orthogonal signals to attain Shannon's limit. Efficiency of Orthogonal signal transmission.

Unit- IV Coding

Need for coding, Parity check bit coding for Error detection, coding for error detection and Correction, Block Codes, Coding and Decoding for block codes, Decoding the Received Codeword, Single Parity-Check Bit Code, Repeated Codes, Hadamard Code, Hamming Code. Algebraic Codes, Burst-error correction.Convolution coding and Decoding, Error in Convolution Codes, Automatic Repeat Request (ARQ).

Recommended Text Books:

1. Electronic Communication system – G.Kennedy
2. Principles of Communication Systems-H-Taub and D.L.Schilling (2nd Edition) TMH
3. An Introduction to Analoh and Digital Communications- Simon Haykin. 2ndEd.Wiely
4. Wireless Digital Communication-KamiloFeher

Reference Books

1. Communication Systems Analog and Digital- R.P.Singh and S.D.Spare, TMH, 2004
2. Digital and Analog Communication Systems – K.SamShanmugam, John Wiely, 2005
3. Communication Systems – B.P.Lathi, BS Publications 2006
4. Principles of Communication Systems - H-Taub and D.L.Schilling and GoutamSahe, 3rdEd.TMH
5. Digital Communications – john Proakis, TMH, 1983

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) III – Semester Syllabus (CBCS)
(For the batch admitted from 2016-2017 onwards)
Paper – III

PHOTO VOLTAICS
(NCEP Specialization)

PHY 303/NCE T

UNIT–I ENERGY RESOURCES - INTERACTION OF LIGHT WITH SEMICONDUCTOR (15H)

Classifications of Energy Resources; Non-Conventional Energy Resources (NCRE)– needs of RE source, advantages and limitations of RE source, Energy from sun, solar spectral distribution-(solar constant, solar insolation, Declination, Azimuth Angles, Direct-Diffuse-Total Solar Radiations). Solar intensity at earth's surface and outside earth's surface. Solar intensity measurements – Pyranometer and Pyrheliometer.

Interaction of light with semiconductor, Direct & Indirect band gap semiconductor, Recombination processes (Radioactive recombination, Auger recombination, Recombination through traps), Basic equations of Semiconductor Device physics (Poisson's equation, Current density equations, Continuity equations, equation set).

UNIT- II JUNCTION DIODES AND SOLAR CELL PARAMETERS (15H)

Introduction to p-n junction, Energy band diagram of p-n junction- p-n junction potential and I-V equation-Carrier concentration profile, Diffusive flow in Quasi-neutral regions, Dark characteristics (Minority carriers in quasi neutral regions, Minority carrier currents). p-n junction under Illumination-Characteristics,

Photo-Voltaic systems (PVS) – types of PV cell, Formation of PV-Cell, Principle of Solar cell (PV-Cell) and merits-limitations of PVS, I-V equation of Solar cell, Solar cell output parameters and their equations, Effect of finite cell dimensions on I_o, Effect of temperature on solar cell performance, Efficiency losses (Short circuit current losses, Open circuit voltage losses, Fill factor losses, Series resistance, Shunt resistance, resistance due to Ohmic contacts).

UNIT- III DESIGN AND FABRICATION OF SOLAR CELLS (15H)

Purification of SiO_2 from Metallurgical grade to semiconductor grade- crystal growth of solar grade Silicon (Amorphous, Crystalline, Polycrystalline). Preparation of Wafers from Si Crystal, Preparation of homo junction Si solar cells, Construction of Solar Cell- PV Module-PV Panel-PV Array.

Thin film solar cells, Preparation of hetero junction, Solar cell interconnection, Collection probability of generated carriers, Junction depth, Lateral resistance of top layer, doping of the substrate, back surface fields, Top layer limitations (Dead layers, high doping effects), Top contact design, Optical design (Anti reflection coating, Texture surfaces & grid structure).

UNIT- IV BATTERIES (15H)

Introduction to Batteries(Basic components of a Battery), Cell to Battery, Classification of Batteries, Definitions of fundamental quantities, factor affecting on battery performance, Different types of battery arrangement, Electrochemical batteries, large capacity approaches, Power conditioning equipment :DC to AC Inverter, AC to DC Converter, difference b/w conventional cell (or) battery and Fuel cell.

Batteries for PV systems: Lead acid batteries, Nickel Cadmium (Ni-Cd) Batteries, Advantages of batteries for bulk energy storage, comparison of batteries, Solar PV systems: Design of PV - powered DC fan without battery and Design of PV powered DC pump.

References:

1. Solar Cells-Operating Principles Technology and system application by Martin A. Green (PHI)
2. Energy Technology: S.Rao & B.B.Parulekar (Khanna Publications)
3. Solar Photovoltaics: Chetan Singh Solanki (PHI).
4. Non-Conventional Energy Resources:D.S. Chauhan. S.K. Srivastava (New AGE)
5. Photovoltaic systems-Analysis & Design: A.K. Mukerjee,Thakur.

DEPARTMENT OF PHYSICS
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M.Sc.(Physics) III – Semester Syllabus (CBCS)
(For the batch admitted from 2016-2017 onwards)
Paper – IV
HYDROGEN ENERGY
(NCEP Specialization)

PHY 304/NCE T

Unit- I Fundamentals of Hydrogen (15H)

Introduction, Physical properties of hydrogen (State and Phase diagrams, Triple point and Toxicity Other gases accompanying Hydrogen) Chemical Properties (Density and specific gravity, Specific volume, Expansion ratio, Hydrogen content), Energy content, Energy density, Flammability, Ignition Energy, Auto ignition temperature, Octane number, Burning speed, Quenching gap, Flame characteristics

Unit- II Production of Hydrogen (15H)

Methods of production of Hydrogen - Production from fossil Sources(steam reforming, partial oxidation, auto thermal reforming), Production by Electrolysis, Alkaline electrolysis, polymer electrolyte membrane(PEM) electrolysis, photo electrolysis, Photo-biological Hydrogen Production, thermo chemical water splitting, Artificial photosynthesis, Hydrogen from Solar energy, from Biomass, from Coal gasification). Chemical byproducts of fuel reaction.

Unit- III Hydrogen Storage and Transportation (15H)

Classification of hydrogen storage devices and systems, Hydrogen storage methods, Liquid hydrogen storage, Metal hydrides, Gas on solids- adsorption (Physisorption and chemisorptions), material based storage, Hydrogen storage in nanostructure carbons, Challenges of hydrogen storage.
Hydrogen transportation (road, train and pipe line), Hydrogen leakage, methods to detect the leakage, Utilization of Hydrogen gas, Hydrogen as an alternative fuel for motor vehicles, safety and management, application of hydrogen energy.

Unit- IV Fuel Cells (15H)

Introduction, Theory of electro-chemistry applied to fuel cells, Principle and operation of fuel cells. Fuels , Oxidants and electrolyte materials for fuel cells, Classification and types of fuel cells, Acidic Electrolyte fuel cells, Alkaline Electrolyte fuel cells, molten carbonate fuel cells(MCFC), Solid Oxide Fuel Cells (SOFC), Methanol fuel cell, Fuel cell with permeable ion exchange membrane(PEMFC), phosphoric acid fuel cell(PAFC),Zinc-Air fuel cell(ZAFC),Regenerative fuel cell(RFC),Reversible fuel cell, Electrical circuit and quantities, Performance characteristics of fuel cells, Heat generated by fuel cells, Gibbs-Helmholtz equation, Advantages, limitations and applications of fuel cells.

Reference:

1. Non Conventional Energy Resources-S. Hasan saeed, D.K. Sharma.
2. Non Conventional Energy Resources –D.S. Chauhan, S.K.Srivastava.
3. Energy Technology- S.Rao and Dr.B.B.Parulekar .
4. Non Conventional Energy Sources- G.D .Rai

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus(CBCS)
(For the batch admitted from 2016-2017 onwards)

Paper – I
MODERN OPTICS & SPECTROSCOPY
(Common for all Specialization)

PHY 401 T

Unit-I Principles of Lasers & Laser Systems

Emission and absorption of Radiation –Einstein Relations, pumping Mechanisms – Optical feedback - Laser Rate equations for two, three and four level lasers, pumping threshold conditions, Laser modes of rectangular cavity –Properties of Laser beams.

Classification of laser systems –Gas and Solid Lasers-Gas lasers and Energy level schemes: He- Ne, Co_2. Solid State lasers: Ruby, Neodymium-YAG lasers

Unit- II Holography & Non-Linear optics

Basic Principles of Holography- Recording of amplitude and phase- The recording medium- Reconstruction of original wave front- Image formation by wave front reconstruction- Gabor Hologram- Limitations of Gabor Hologram-Off axis Hologram- Fourier transform Holograms- Volume Holograms, Applications of Holograms- Spatial frequency filtering.

Non-Linear Optics-Harmonic generation- Second harmonic generation- Phase matching condition- Optical mixing- Parametric generation of light –Self focusing of light.

Unit- III Atomic Spectra

Different series in alkali spectra (main features), Ritz combination principle, Terms for equivalent & non-equivalent electron atom, Term values in alkali spectra and quantum defect, L-S and j-j coupling; Energy levels and spectra; Spectroscopic terms.

Spin-Orbit interaction, doublet structure in alkali spectra, selection rules, intensity rules, alkali-like spectra, Lamb shift, many electron atoms, isotope shift; hyperfine splitting of spectral lines, selection rules. Lande interval rule.

Unit- IV Molecular Spectra

Types of Molecular spectra, Regions of the Spectrums, Salient features of rotational spectra, rotational spectra of diatomic molecule as a rigid rotator, Energy levels and spectra of a non-rigid diatomic molecule, effect of isotopic substitution on rotational spectra, salient features of Vibrational-Rotational spectra, vibrating diatomic molecule as a harmonic oscillator and as anharmonic oscillator. Diatomic molecule as rigid rotator and harmonic oscillator diatomic molecule as a non-rigid rotator and anharmonic oscillator.

Recommended Books:

7. Opto Electronics- An Introduction–Wilson & JFB Hawkes 2nd Edition.
8. Introduction to Fourier optics –J.W. Goodman
9. Lasers and Non-Linear optics –B.B. Laud
10. Optical Electronics –GhataknndThygaRajan.
11. Principles of Lasers –O. Svelto
12. Atomic Spectra & Atomic Structure- Gerhard Hertzberg
13. Fundamentals of Molecular Spectroscopy - C.N. Banwell and EM Mc Cash
14. Atomic and Molecular Spectroscopy- Raj Kumar
15. Molecular Structure & Spectroscopy- G.Aruldhas
16. Introduction to Atomic Spectra- H.E.white

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus(CBCS)
(For the batch admitted from 2016-2017 onwards)
Paper – II
PHYSICS OF PHONONS & NANOMATERIALS
(Common for all Specialization)

PHY 402 T

Unit-I Phonons & Diffusion in solids

Phonons and their properties–Crystal momentum–Neutron diffraction from phonons–Thermal conductivity–Role of phonons in Thermal conductivity–Normal and Umklapp processes–Photon–Phonon interaction–TO and LO phonons.

Solid state diffusion, Self-diffusion, Impurity diffusion, Fick's second law, Diffusion coefficient, Random walk diffusion and correlated and uncorrelated motions, Diffusion in a simple cubic structure, Diffusion under external field, Nernst-Einstein relation, Correlation factor'f', Kirkendall shift. Ionic conductivity, Ionic conductivity of alkali halides and effect of divalent impurities on ionic conductivity.

Unit- II Superconductivity

Occurrence of superconductivity. Experimental observations –persistent currents, effect of magnetic field, Meissner effect, Type I and type II superconductors. Isotope effect, entropy, heat capacity and thermal conductivity. Energy gap.

Theoretical explanations:-penetration depth, London equations. Cooper pairs and elements of BCS theory. Giaver tunneling, Josephson effects (Basic ideas only). Elements of high temperature superconductors (basic concepts).Applications of superconductors.

Unit- III Classification & Synthesis of Nanomaterials

Introduction to Nanomaterials, Role of size in nanomaterials, Classification of Nano structured materials- 0D, 1D, 2D, 3D. Nanowires, Nanoclusters, Quantum wells

Synthesis routes and Methods: Top down, Bottom up. Physical methods: Inert gas condensation-Arc discharge-RF Plasma-vapour deposition. Chemical Methods: Chemical nucleation theory for cluster formation, Metal nanocrystal by reduction method. Hybrid methods: Sol-gel process

Unit- IV Characterization Methods

Characterization: Introduction, Structure of Nanomaterials-X-Ray Diffraction (XRD)-The powder method. Electron Microscopy: Atomic Force Microscopy (AFM), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

Spectroscopy Techniques: Introduction, Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, DSC, UV - VIS spectroscopy.

Reference:

1. Solid state physics - G.Burns;
2. Solid State physics- Dekker
3. Solid State physics-Wahab.
4. Textbook of Nanoscience and Nanotechnology-B.S.Murthy, P.Shankar, Baldev Raj, BB Rath and James Murday, University Press, IIM, Metallurgy and Material Science.
5. Principles of Nanoscience and Technology, M.A.Shah, Tokeer Ahmad, Narosa Publishing House.
6. Springer Handbook of Nanotechnology – Bharath Bhushan
7. Chemistry of Nanomaterials: Synthesis, Properties and applications by C.N.R.Rao et al.
8. Nano Materials Handbook- Yury Gogosti

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus as per CBCS
(For the batch admitted from 2016-17 onwards)
Paper – III
OPTICAL FIBER COMMUNICATION
(Electronic Communication Specializations)

PHY 403/EC T

Unit-I Optical Fiber Preparation &Wave guiding

Ray Transmission in Optical Fiber: Basic Structure of Optical Fiber, Ray Theory of Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Step Index Optical Fiber, Graded Index Optical Fiber, Single Mode and Multi-Mode Optical Fibers.

Fiber Material Preparation Techniques; Outside Vapor Pressure oxidation, Vapor Axial Deposition, Modified Chemical Vapor Deposition, Plasma Activated Chemical Vapor Deposition. Fiber drawing processes-Double Crucible Method. Cable Designing, Splices & Connectors.

Wave guiding: Electromagnetic Mode Theory for Optical Propagation, Mode theory of circular waveguides, Single mode fibers, Graded index fiber – WKB approximations for estimating number of modes.

Unit-II Transmission Characteristics

Signal Degradation (Fiber Losses): Attenuation, Absorption, Intrinsic Absorption, Extrinsic Absorption, Leaky Modes, Rayleigh Scattering losses, Macro and Micro Bending losses, Radiation Losses, Core and Cladding Losses, Signal distortion in optical waveguides (Pulse broadening). **Overview of Dispersion Origins**: Intermodal and Intramodel (Chromatic) Dispersion, Material Dispersion, Waveguide Dispersion, Polarization-mode Dispersion, Electrical Vs Optical Bandwidth, Bandwidth-Length Product, Dispersion Calculation, Mode- Field Diameter.

Unit- III Optical sources and detectors

Optical Sources: Basic Semiconductor Properties, Light source materials, internal quantum efficiency, modulation capability, transient response, power bandwidth product, Types of Light Emitting Diode (LED) Structures: Planar LED, Dome LED, Surface Emitter LED and Edge EmitterLED.

Optical Detectors: Characteristics of Photo detectors, Photo emissive Diode, Photoconductive Diode and Photo Voltaic Diode, Injection laser diodes, PIN Photo detectors, Avalanche Photodiodes (APD), Photo Transistor.

Unit- IV Communication systems

Review of Multiplexing techniques: Optical Time Division Multiplexing (OTDM), Wavelength Division Multiplexing (WDM). Coherent optical fiber detection system, Coherent detection principle, Coherent system performance.Comparison of direct and coherent detection performance. Practical coherent system constraints.

Coherent Optical Communication Experiments Homodyne System Experiment Gas Lasers, Heterodyne System Experiment Using External Cavity Lasers, Heterodyne System Experiment Using a Distributed- Feedback (DFB) Laser Transmitter.

Reference:

1. Optical Fiber Communication – Gerad Keiser 3rd Ed.MGH2000
2. Optical Fiber Communication – John M Senior, 2nd Ed.PHI,1999
3. Optical Fiber Communication – SC Guptha, PHI
4. Optical Fibers – T.Gowar
5. Optical Fiber Communication – Joseph C Palais PEA 4th Ed. 2nd Indian Reprint 2002
6. Optical Fiber Communication Principles and systems – A,SalvarajanS.Kar and T.Srinivas, TMH, 2002
7. Introduction to Fiber Optics- A. Ghatak and Tyagarajan(Cambridge UniversityPress)

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus as per CBCS
(For the batch admitted from 2016-17 onwards)
Paper – IV
SATELLITE & MOBILE COMMUNICATION
(Electronic Communication Specializations)

PHY 404/EC T

Unit-I Satellite Communication-I

Satellite orbit and Positioning, Satellite speed, height, Period, Angle of inclination. Geosynchronous orbits. Position co ordinates, Azimuth and elevation. Satellite Communication systems – Repeaters and Satellite transponders, Frequency allocations for transponder channels. Satellite sub systems, Transponder configurations, Multi channel Architecture, Satellite orbit control. Power subsystems, Telemetry, Command and Control sub systems.

Unit- II Satellite Communication-II

Ground stations, Antenna sub systems, Receiver sub systems, Transmitter sub systems. Power sub systems, Telemetry and control Sub systems. International and Regional Satellites, Domestic satellites.

Satellite Applications: Communication satellites, Surveillance satellites, Navigation satellites. Global Positioning Systems (GPS) – Space segment, Control segment, Atomic clocks. GPS receivers, GPS applications.

Unit- III Mobile – Cellular Communications

Introduction to Cellular Mobile System: Significance of cellular mobile systems, Frequency spectrum allocation. Trunking efficiency. A basic cellular system. Performance criteria, operation of cellular systems. Hexagonal shaped cells, planning a cellular system. Elements of cellular system design, Frequency Re-use, Co channel interference reduction factor, Hand off mechanism, Cell splitting. The concept of spread spectrum: Frequency hopping spread spectrum, direct sequence spread spectrum.

Unit- IV Analog and Digital Cellular Systems

Definitions of terms and functions. Introduction to digital technology. Advantages of digital systems. ARQ Techniques. Digital speech. Digital Mobile Telephony, Multiple access schemes, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA).Frequency Division Multiple Access (FDMA), Global System for Mobile (GSM), Architecture, Layer modeling (OSI Model).

Reference:

1. Principles of Electronic Communication Systems- Louis E Frenzel, 3rd Ed.MGH
2. Composite satellite and cable television – R.R.Gulati, Revised 2nd Ed.New Age International
3. Mobile Cellular Telecommunications – William CY Lee, 2nd Ed. MGH
4. Mobile Communications – Jochan.H.Schiller
5. Wireless Digital Communications – Kamilo Feher
6. Communications – Dennis Roddy & John Coolen, PHI, 2000.
7. Principles of Communication system – H.Taub & D.L.Schilling,2nd Ed.TMH 1999
8. Electronic Communication Systems- George Kennedy, TMH
9. Cellular and Mobile Communications- V.Jeyasri, Arokiamary,1st Ed.Technical Pub.2009

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus (CBCS)
(For the batch admitted from 2016-2017 onwards)
Paper – III

SOLAR THERMAL ENERGY
(NCEP Specialization)

PHY 403/NCE T

Unit-I. Heat transfer systems (15H)

Modes of heat transfer, Conduction mode of heat transfer- Fourier's Law of Heat Conduction, 1-D heat conduction through plane wall -composite walls-hallow cylinders-pipes. Thermal conduction, Thermal resistance - Analogy between heat and electricity flow, the energy balance.

Convection mode heat transfer: Mechanism of natural and forced convection, dimensionless numbers and their physical significance, Radiation heat transfer: blackbody- exchange, Sky Radiation, Combined heat transfer systems :(Convection and Radiation in parallel, Convection and Conduction in series, overall heat transfer coefficient).

Unit- II. Liquid Flat Plate Collector and Solar Concentrators (15H)

Liquid flat plate collector, materials for flat plate collector, Absorber plate, efficiency of flat plate collector, improving efficiency of flat plate collector, Overall heat loss coefficient, heat loss from the top of collector plate, selective surfaces of flat plate collector, Flat plate air heating collectors: Types of air heating collectors, testing of solar collector.

Classification of solar concentrators, Parameters characterizing concentrators, Thermodynamic limits to concentration, performance analysis of cylindrical parabolic collectors, compound parabolic collectors, materials for solar concentrators.

Unit- III. Solar Refrigeration - Air Conditioning and Solar Energy Storage (15H)

Solar refrigeration - air conditioning, Carnot Refrigeration cycle, Absorption cooling: principle of absorption cooling, basics of absorption cooling, Lithium Bromide - Water absorption system, Aqua-Ammonia absorption system, Intermittent absorption refrigeration system, Vapors compression refrigeration.

Need of thermal energy storage, size and duration of storage, thermal energy storage: Operating modes, single tank storage system, sensible heat storage, storage in phase change materials, storage in reversible chemical reactions.

Unit- IV Applications of Solar Energy (15H)

Solar water heating - built in storage type of solar water heater, Types of Solar Cookers: Direct (focusing) type, Indirect (box type), advanced type. Solar desalination, Simple Solar Still: basics of Solar Still, Wick type solar still. Solar energy for industrial use.

Basics of solar drying, types of solar dryers: Natural Convection type, mixed mode type. Solar furnaces: Types of Solar Furnaces, components of solar furnaces, typical solar furnaces design**.**

Reference:

1. Solar Energy: H P Garg and J Prakash (TMH)
2. Solar Energy: S P Sukhatme (TMH)
3. Solar Energy: G N Tiwari (Narosa)
4. Heat Transfer by J P Holman, McGraw Hill
5. Heat Transfer: Principles and Applications by Dutta, Binay K, PHI Publication

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc.(Physics) IV – Semester Syllabus (CBCS)
(For the batch admitted from 2016-2017 onwards)
Paper – IV

ENERGY CONVERSION SYSTEMS
(NCEP Specialization)

PHY 404/NCE T

Unit-I Wind energy – Wind turbine-Wind Turbine Plants (15H)

Introduction to wind energy, origin of wind, Nature of wind , mean wind velocity, power in a wind stream, power of a wind turbine for given incoming wind velocity, wind turbine efficiency, forces on blades of a propeller, Wind form site selection.

Types of wind turbine, Construction and working of Horizontal axis wind turbine generator unit (mono, twin, three blades), yaw control, pitch control, Tethering effect, Blade design. Construction and working of vertical axis wind turbine generator unit (Darrieus Rotor, H – rotor), Blade design.

Grid connection, Energy storage requirements with wind energy systems, wind turbine generator with battery storage facility, wind turbine generator with diesel generator, wind turbine generator with Solar cell ,wind hybrid. Applications of wind energy, merits and limitations of wind energy.

Unit- II Geothermal energy (15H)

Introduction, Nature of geothermal fields, Origin of geothermal resources, Non-uniform geothermal gradients ,Geothermal energy resources-Hydrothermal (convective) resources (vapor and liquid dominated systems), Geo pressured resources, Hot Dry Rock(HDR) resources (petro geothermal systems), Molten rock-chamber systems, comparison of flashed steam and total flow concept, , Advantages and Disadvantages of geothermal energy, Applications of geothermal energy.

Unit- III Ocean Energy (15H)

Introduction, Ocean Thermal Electric Conversion (OTEC), methods of OTEC power generation, open cycle OTEC systems, closed of Anderson OTEC cycle, hybrid cycle, energy from tides, basic principle of Tidal power, Components of tidal power plants, operation methods of utilization of tidal energy, estimation of energy and power in simple single basic tidal systems & double cycle system. Ocean waves, Advantages and disadvantages of wave energy. Energy & power form waves, wave energy conversion devices.

Unit- IV Bio Energy (15H)

Availability of Biomass, Materials for biogases, Biomass conversion process (Direct combustion, thermo chemical conversion, Biochemical conversion), Production of Bio gas, Factors affecting generation of gases.

Types of Biogas plants-Batch type Biogas plant, Continuous type Biogas plant, Movable Drum type plant, Fixed Dome type plant, Comparison between Movable Drum type and Fixed Dome type plants. Biogas plants in India- Deenabandhu Biogas plant, Gayatri model plant, Manipal model, spherical Biogas plant, Mud jar Biogas plant. Selection of site for Biogas plant.

Reference:

1. Energy Technology: S. Rao and Dr.B.B.Parulakar
2. Non conventional Energy Sources: G.D.Rao
3. Non conventional Energy Resources: S.Hasan saeed, D.K.Sharma

DEPARTMENT OF PHYSICS
MAHATMA GANDHI UNIVERSITY-NALGONDA
M.Sc (PHYSICS) COURSE PRACTICAL SYLLABUS FOR SEM – III & IV

PHY-305 P& 405 P

MODERN PHYSICS PRACTICALS
(COMMON TO ALL SPECIALIZATION)

SPECTROSCOPY LAB

1. Hall Effect
2. Energy gap
3. Magnetic Susceptibility / B-H curve
4. Conductivity – four probe method/Two probe method
5. Dielectric Constant
6. Solar cell characteristics
7. Zeeman effect
8. Ultrasonic experiment (Diffraction method)

NUCLEAR PHYSICS LAB

1. Determination of Characteristics of GM Detector
2. Dead time of GM Detector
3. Absorption of beta rays in Al, Cu & Pb
4. Absorption of gamma rays in Al, Cu & Pb
5. Verification of Inverse square law
6. Determination of long life of radioactive substance (KCl)

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M.Sc (PHYSICS) COURSE PRACTICAL SYLLABUS FOR SEM – III & IV

PHY-306/EC P& 406/EC P
ELECTRONIC COMMUNICATION SPECIALIZATION

AM, FM, Pulse Modulation & Demodulation Techniques

1. Amplitude Modulation & Demodulation.
2. Frequency Modulation & Demodulation.
3. Pulse Code Modulation & Demodulation.
4. Pulse Amplitude Modulation & Demodulation.
5. Pulse Width Modulation & Demodulation.
6. Pulse position Modulation & Demodulation.
7. Delta Modulation & Demodulation.
8. FSK Modulation & Demodulation.
9. PSK Modulation & Demodulation.
10. Analog and Digital Time Division Multiplexing and Demultiplexing.
11. Verification of Sampling Theorem.

Microwave Techniques

1. VSWR Measurements, Insertion loss or Attenuation.
2. Impedance and Frequency Measurement.
3. Reflective coefficient.
4. Determination of Standing Wave ratio (Low, High)
5. Reflex Klystron characteristics.
6. Attenuation Measurements.
7. Waveguide Parameters measurements.

Optical Fiber Communication

1. Measurement of Numerical Aperture.
2. Study the characteristics of optical source (LED) and Photo Detector.
3. Study of characteristics of LASER Source.
4. Setting up of Fiber Optic Analog Link and Digital link.
5. Measurement of propagation loss. Bending loss and Connector loss.
6. Measurement of length of the cable.
7. Study the effect to lateral, Longitudinal and Angular Displacement.

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M.Sc (PHYSICS) COURSE PRACTICAL SYLLABUS FOR SEM – III & IV

PHY-306/ NCE P& 406/NCE P

NON-CONVENTIONAL ENERGY PHYSICS PRACTICALS

1. Efficiency of DC electric motors in pumping system.
2. Study of Diesel generator system.
3. Measurement of load and power factor for the electrical utilities.
4. Performance evaluation of air compressor.
5. Experiments based on energy conversion and their utilization in electrical and mechanical systems.
6. Study of Solar collector – Efficiency
7. Study of hot water system
8. Study of Solar hot air collector/Solar dryer
9. Study of Solar cooker.
10. Power vs Load characteristics of SPV system
11. Variation of power output with intensity of solar radiation and load.
12. Study of Variation of power output from solar cell with different angles
13. Determination of efficiency of SPV water pump.
14. Determination of efficiency of DC/AC Inverter.
15. Study of storage battery- Charging and Discharging characteristics and maintenance.
16. Wind power and annual energy estimation from wind data.
17. Solar cell characteristics.
18. Energy audit of the following installations
    (a) Building Lighting
    (b) Air Conditioning System
    (c) Running Vehicles

20. To determine the normalized open circuit Voltage and Fill factor

21. To Compare efficiency of thin film solar cell and crystalline solar cell
22. Hydrogen Fuel Cell characteristics & Production of hydrogen