DEPARTMENT OF PHYSICS
PALAMURU UNIVERSITY

REVISED SYLLABUS FOR
M.Sc.(PHYSICS) SEMESTER - III
With effect from the academic year 2023 –2024 onwards

S.No	Paper code	Paper	Paper title	Instructions Hrs / Week (L + CCE)*	Credits	Max Marks
1.	PHY301T	Paper-I	Modern Optics	3+2	3	100
2	PHY302T	Paper-II	Advanced solid state physics	3+2	3	100
Solid State Physics (SSP)						
3	PHY303T/SSP	Paper-III	Band Theory & electrical Properties	3+2	3	100
4	PHY304T/SSP	Paper- IV	Crystal Physics and Physics of Phonons	3+2	3	100
Electronics & Instrumentation(E&I)						
5	PHY303T/EI	Paper-III	Electronic Instrumentation	3+2	3	100
6	PHY304T/EI	Paper- IV	Embedded Systems and its applications	3+2	3	100
Nano Science (NS)						
7	PHY303T/NS	Paper-III	Synthesis and Characterization of Nano materials	3+2	3	100
8	PHY304T/NS	Paper- IV	Properties of Nano materials	3+2	3	100
PRACTICALS						
9	PHY305P	Paper-V	Modern Physics-I	4	2	50
10	PHY306P	Paper-VI	Nuclear Physics - I	4	2	50
11	PHY307P/SSP or PHY307P/EI or PHY307P/NS	Paper-VII	Solid State lab –I Or Electronics and Instrumentation Lab – I Or Nano Science Lab – I	4	2	50
12	PHY308P/SSP or PHY308P/EI or PHY308P/NS	Paper-VIII	Solid State lab –II Or Electronics and Instrumentation Lab – II Or Nano Science Lab – II	4	2	50
			Total	28 + 8	20	600

Details of credits and marks	
Number of instruction hours per each theory paper per week (L+CCE)*	3+2
Maximum marks for each theory paper	100 (60 semester exam + 40 internal evaluation)
Number of credits for each theory paper	3
Total Number of instruction hours per practical papers per week	16
Maximum Marks per each practical paper	50
Number of credits per each practical paper	2
Number of Practical Papers	4
Total Credits per semester	20

L* – Lecture; CCE* – Comprehensive Continuous Evaluation

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DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - Semester-III

Syllabus

(For the batch admitted from 2023-24 onwards)

Paper–I (Common for all Specializations)

Course Code	Course Title
PHY301T	**MODERNOPTICS**

Course Objectives: This course enables the students:

COB1	To identify conditions for lasing phenomenon and properties of the laser.
COB2	Toclassifydifferenttypesoflaserswithrespecttodesignandworkingprinciples.
COB3	Tounderstandthebasicsofhologramsandabletodifferentiatebetweenholographyand Photography.
COB4	To understand the concept of Fourier transforming properties of lenses.
COB5	To understand the concept of non-linear optical process in which photons of intense incoming laser radiation interact with a non-linear material and how radiation with corresponding Harmonic frequencies are generated.

Course Outcomes: After the completion of this course the student will be:

COC1	Able to evaluate conditions for lasing phenomenon and properties of the laser.
COC2	Able to appraise different type of lasers with respect to design and working principles.
COC3	Abletoidentifytheparameterswhichdifferentiatehologramsfromphotographs
COC4	Able to distinguish between various types of holograms and to analyze the different parameters of holographic recording materials.
COC5	Able to evaluate intensity dependent material properties like refractive indices, optical mixing and self-focussing of light.

Unit I: Lasers: Emission and absorption of Radiation, 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. Argon, CO_2 Gas lasers, Excimer laser, Nd-YAG laser, Semiconductor lasers: Ga-As lasers and their applications.

Unit II: Holography: Basic Principles of Holography- Recording of amplitude and phase, there 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.

Unit III: Fourier and Non-Linear Optics: Fourier optics- Thin lens as phase transformation, Thickness function, Fourier transforming properties of lenses, Object placed in front of the lens, Object placed behind the lens.

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

Recommended Books:

1. Opto Electronics-An Introduction–Wilson & JFBHawkes2nd Edition.
2. Introduction to Fourier optics–J.W.Goodman
3. Lasers and Non-Linear optics–B.B. Laud
4. Optical Electronics–Ghatak and Thyagarajan.
5. Principles of Lasers–O.Svelto
6. Laser fundamentals – Silfvast Cambridg

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY
M.Sc.(Physics)-Semester-III Syllabus
(For the batch admitted from 2023-2024 onwards)
Paper–II (Common for all Specializations)

Course Code	Course Title
PHY302T	**ADVANCEDSOLIDSTATEPHYSICS**

Course Objectives: This course enables the students:

COB1	To understand the electronic properties of metals by studying the Brillouinzones and Fermi surfaces.
COB2	To study the effect of electric and magnetic fields on Fermi surfaces in metals.
COB3	TounderstandthebasicconceptofDielectricsandMagneticpropertiesofsolidsand different Types of polarizabilities, ferro electrics and their properties.
COB4	To understand the classification of magnetic materials and the theories to explain Ferromagnetism,Anti-ferromagnetismandFerri-magnetismandtheirapplications.
COB5	To study the superconductivity and their properties and to understand the ories to explain the superconductivity and their applications.

Course Outcomes: After the completion of this course the student will be:

COC1	Able to understand and gain the knowledge of electrical, dielectric and magnetic properties of solids and superconductivity and its applications.
COC2	Able to construct the Brillouin zones and Fermi surfaces and to identify the energy bands in solids.
COC3	Able to distinguish different types of polarizabilities and their behavior in AC fields and to classify the ferroelectric materials and their properties
COC4	Able to identify different types of magnetic materials and their applications.
COC5	Able to understand superconductivity its properties and applications.

Unit I: Electronic Properties
Introduction to band theory of solids. Fermi surface and Brillouin zones. Construction of Fermi surfaces. Extended, periodic and reduced zone schemes. Fermi surfaces in simple cubic, bcc and fcc lattices. Effect of electric and magnetic fields on Fermi surfaces. Anomalous and skin effects.

Unit II: Dielectrics and Magnetic properties of solids
Introduction to Dielectrics, Concept of local field. The electronic, ionic and orientational polarizabilities. Clausius-Mosotti relation. Behavior of dielectrics in an alternating field, Classification of ferroelectrics- $BaTiO_3$and KDP. Dipole theory of ferroelectrics, ferroelectric hysteresis.Origin of permanent magnetic moment, Spontaneous magnetization, Weiss theory of spontaneous magnetization. Nature and origin of Weiss molecular field, Heisenberg exchange interaction. Ferromagnetic domains and hysteresis. The Bloch wall, Neel's theory of anti-ferromagnetism. Ferrimagnetism, ferrites and their applications(basic concepts only).

Unit III: Superconductivity

Introduction to type-I and type-IIsuperconductors, Isotope effect, entropy, heat capacity and thermal conductivity. Energy gap, London equations, penetration depth, Coherence length, Cooper pairs and elements of BCS theory, BCS ground state. Giaver tunneling, DC and AC Josephson effects(basic ideas only). Elements of high temperature superconductors (basic concepts) and applications.

RecommendedBooks:

1. Solid State Physics --A.J.Deckker
2. Introduction to Solid State Physics --Kittel
3. Solid State Physics --R.L.Singhal
4. Elements of Solid State Physics --J.P.Srivastava
5. Solid State Physics --M.A.Wahab

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc.(Physics)-Semester-III Syllabus (Solid State Physics)

(For the batchadmittedfrom2023-2024onwards)

Paper–III

Course Code	Course Title
PHY303T/SSP	**BANDTHEORYANDELECTRICALPROPERTIES**

Course Objectives: This course enables the students:

COB1	To understanding the structure of crystals structures with examples, and the study of Energy versus wave vector relations.
COB2	To define Brillouin zones in one, two and three dimensions and how the density of states are distributed and to understand the energy versus wave vector representations in in one, two and three dimensions.
COB3	To understand the behavior of an electron in cellular method, APW method, Pseudo potential method, OPW method and the studying the variation of energy with momentum vector in the above mentioned methods.
COB4	To understand the transport properties of semiconductors and metals limited by electric current density J in the presence of electric field.
COB5	To understand the electrical conduction from the hopping of electrons from one site to another site in the crystal.

Course Outcomes: After the completion of this course the student will be:

COC1	It enables the students to understand the structure of crystals in 1, 2 and 3 dimensions. It also helps to understand the variation of energy (E) of an electron with its moment vector (K). E vs K variation is not linear but is discontinuous at the boundaries of the Brillouin zones defined as first, second, third etc. separated by certain values of K.
COC2	Able to determine the quantities such as such as electrical conductivity, current density for an electron in the presence of electric field.
COC3	Able to determine the electrical conduction is from the hopping of electrons from one site to another site in hoppers or electron transfer materials.
COC4	Able to identify the phenomena of conductivity in ionic crystals are due to the movement of ions from one site to another site.
COC5	Able to understand the structures of a-AgI and ß-alumina unit cell and the defects present in their structures and the properties of super ionic conductors.

Unit I : Band Theory Of Solids : Brillouin zones.- Brillouin zones in one, two and three dimensions., Density of states, Extended, reduced and periodic zone schemes; Nearly free electron model, Tight binding approximation and its application to simple cubic lattice, Calculation of energy bands- Cellular method, APW method, Pseudo potential method, OPW method.

Unit II : Transport Phenomenon In Metals: The Boltzmann transport equation, Electrical conductivity, Definition and experimental features –The Drude Lorentz theory, The Sommerfeld

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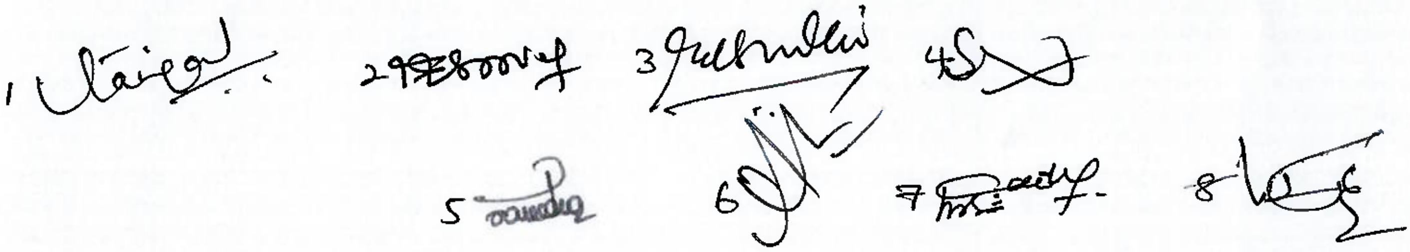
theory- Calculation of the relaxation time, The electrical conductivity at low temperatures, Matheissen's rule, Thermal conductivity, Wiedemann - Franz law, Hall-effect-Hall coefficient and Hall angle.

Unit III : Electrical Transport Properties of Insulators : Hopping conduction; Temperature variation of electrical conductivity; Seebeck coefficient; Polarons- small polaron band conduction; large polaron band conduction; small polaron hopping conduction; Mott transitions; Ionic Conductivity- conductivity, mobility, Nernst-Einstein relation; Superionic Conductivity- structure, structures of α-AgI and β-alumina unit cell; Defects-defect equilibria and conductivity; Properties of super ionic conductors

Recommendedbooks

1. Principles of the theory Solids – Ziman
2. Solid state Physics - Singhal
3. Solid state Physics – H.C. Gupta
4. Elementary SolidState Physics – M.Ali Omar
5. SolidState Physics – M.A. Waheb
6. SolidState Physics – Kachava,



DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc.(Physics)- III Semester Syllabus (Solid State Physics)

(For the batch admitted from 2023-2024 onwards)

Paper–IV

Course Code	Course Title
PHY304T/SSP	**CRYSTAL PHYSICS AND PHYSICS OF PHONONS**

Course Objectives: This course enables the students:

COB1	To study the basic crystallographic point groups and space groups of crystal structures.
COB2	To learn Mullikan symbolism and rules of crystal symmetry
COB3	To understand the concept of phonons.
COB4	To learn phenomenological description of diffusion.
COB5	To study the theoretical concepts of ionic conductivity in detail.

Course Outcomes: After the completion of this course the student will be:

COC1	It enables the students to understand the complete concepts of crystal structure and symmetry Operations.
COC2	Able to draw characteristic tables, which describes the complete set of irreducible representations of a symmetry group.
COC3	Able to determine the role of phonons in the conductivity and interaction processes.
COC4	Able to identify different types of diffusion process with the help of phenomenological theories like Nernst-Einstein relations.
COC5	Able to understand the effect of divalent impurities on ionic conductivity.

Unit I : Elements of group theory: Introduction to crystallographic point groups, the five platonic solids, procedure for symmetry classification of molecules, class, matrix notation for geometrical transformations, matrix representation of point groups, reducible and irreducible representations, great orthogonality theorem and its consequences, Character tables for $C_{2}v$and $C_{3}v$point groups, Mullikan symbolism, Symmetry species.
Development of theoretical formalism, tensors, Physical property and its tensorial representation. Quotient theorem, Symmetry in crystals - point groups and space groups.

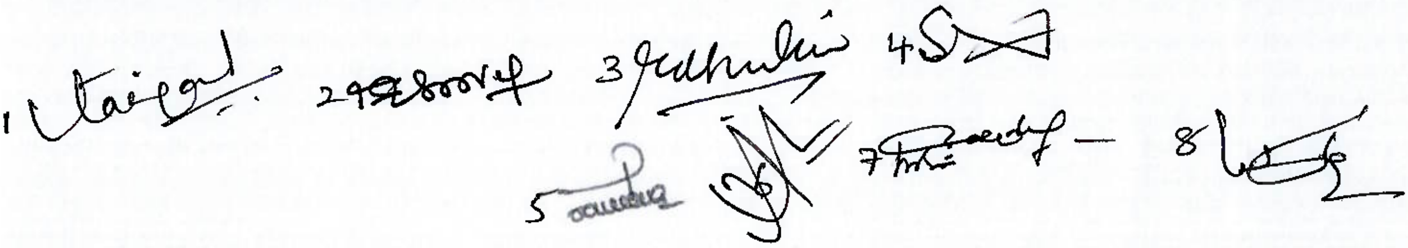
Unit II: Phonon Physics :Theoretical background of lattice vibrations – Phonons and their properties – Crystal momentum – Conservation – Neutron diffraction from phonons – Experimental verification of dispersion relations – Thermal conductivity – Role of phonons – Thermal conductivity – Normal and Umklapp processes – Photon –Phonon interaction – TO and LO phonons – Lyddane– Sach–Teller's (LST) relation – Applications – Infrared measurements, Raman effect – Theory of polaritons – Experimental measurement.

Unit III: Diffusion in solids :Solid state diffusion, Diffusion mechanisms, Self-diffusion, Impurity diffusion coefficient, Fick's second law, Diffusion coefficient, Experimental determination of diffusion coefficient, Various methods, Random walk diffusion, Diffusion in a simplecubicstructure,Diffusionunderexternalfield,Nernst-Einsteinrelation,Kirkendallshift.

Ionic conductivity, Ionic conductivity of alkali halides and effect of divalent impurities on ionic conductivity.

Recommended Books

1. Solid State Physics - G. Burns;
2. Intermediate Quantum Theory of Crystalline Solids – Alexander O E Animalu
3. Solid State Physics – H .Ibach and H. Luth
4. Fundamentals of Solid State Physics – J.R. Christman,
5. Solid State Physics, Solid State Device and Electronics, Kachhava, C. M..
6. Solid State Physics – A.J. Dekker
7. Solid State Physics –M A Wahab.
8. Chemical applications of group theory F.A. Cotton
9. Physical properties of crystals J.F.Nye;
10. Physics of crystals S.Bhagavantam and S.Radhakrishna,



DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - Semester-III Syllabus (E&I)

(For the batch admitted from 2023-2024 onwards)

Paper–III

Course Code	Course Title
PHY 303T/EI	**ELECTRONIC INSTRUMENTATION**

Course Objectives: This course enables the students:

COB1	To study the basic measurement of errors.
COB2	To study characteristics of instrumentation system.
COB3	To understand the concept of instrumentation amplifier and attenuators.
COB4	To learn about signal generation and analysis.
COB5	To study the electronic measuring instruments.

Course Outcomes: After the completion of this course the student will be:

COC1	It enables the students to understand the accuracy and precision in measurement. COC2
COC2	Able to understand the response of the system.
COC3	Able to measure power and voltage measurement.
COC4	Able to read oscilloscope measurements.
COC5	Able to understand LED and seven segment display systems.

UnitI: Measurement and Error:

Accuracy and Precision–significant figures –Types of error –Statistical analysis-Probability of errors –Limiting errors.

Performance characteristics of an instrumentation system: Zero, First and Second Order systems –Response of first and second order systems to STEP, RAMP and IMPULSE inputs-Frequency response of first and second order systems.

Unit II: Amplifiers and Signal Conditioning:

Instrumentation amplifiers- Isolation amplifiers- Logarithmic amplifiers-Attenuators-.

Second order active filters –Low pass, High pass, Band pass, and Band stop filters- All pass filters. Phase sensitive detector (PSD).

Signal Generation:

Frequency synthesized signal generator- Frequency divider generator- Function generator – Noise generator. **Signal Analysis:** Wave Analyzer- Heterodyne wave analyzer-Harmonic distortion analyzer- Spectrum analyzer-Spectra of CW, AM, FM and PM waves.

Unit III

Electronic Measuring Instruments:

Digital frequency meter–Digital voltmeter–Phase meter–RF power and voltage measurement.

Display and Recording: Magnetic tape Recorders- Laser printers–Storage oscilloscope.
Characteristics of digital displays: LED and seven segment display systems.

Recommended Books

1. Modern Electronic Instrumentation and Measurement Techniques –A.O. Helfrick and W.D.Cooper, Prentice Hall India Publications.
2. Instrumentation Devices and Systems –C.S Rangan, G.R. Sharma and VSV Mani, Tata McGraw Hill Publications.
3. Introduction to Instrumentation and Control –A.K Ghosh –PHI Publications.
4. Electrical and Electronics Measurement and Instrumentation –A.K.Sawhney.
5. Transducers and Instrumentation- D.V.S Murty PHI Publications.

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - III Semester Syllabus (E&I)

(Forthebatchadmittedfrom2023-2024onwards)

Paper–IV

Course Code	Course Title
PHY304T/EI	**EMBEDDED SYSTEMS AND ITS APPLICATIONS**

Course Objectives: This course enables the students:

COB1	To study the functional block diagram of microcontroller 8051.
COB2	To study memory and programming aspects of microcontroller 8051.
COB3	To understand the concept of PIC microcontrollers.
COB4	To learn about interfacing with microcontroller 8051.
COB5	To study the PID and Stepper motors.

Course Outcomes: After the completion of this course the student will be:

COC1	It enables the students to understand the working of microcontroller 8051.
COC2	Able to program microcontroller 8051.
COC3	Able to interface microcontroller 8051 with keyboard, LED, 7-Segment displays.
COC4	Able to measure Strain gauge.
COC5	Able to understand working of LVDT; PID and Relay systems.

Unit I

The 8051 Microcontroller

Blockdiagramofthe8051;ProgramCounterandROMspace,DateTypesand Directives,PSWRegister,RegisterBanksandStack;**PinDescription**,I/OProgramming,AddressingModesof8051.Arithmeticinstructionsandprogramming: Add, Subtract, Multiplication and Division of Signed and Unsigned numbers; Logical Instruction and Programs- Logic, Compare, Rotate, Swap, BCD and ASCII Application Programs; Single Bit Instructions with CY; Jump, Loop and CALL Instructions, Time Delay Generation and Calculation; Timer/Counter Programming, Serial Communication an interrupts Programming.

Unit II

PIC Microcontrollers

PIC 16C6X/7X Architecture (PIC 16C61/C71), Registers, Pin diagram, Reset action Memory Organization, **Instructions**, Addressing Modes, I/O Ports, Interrupts, Timers, Analog-to-Digital Converter (ADC).

PinDiagramofPIC**16F8XXFlashMicrocontrollers**,Registers,Memoryorganization, Interrupts, I/O Ports and Timers.

Unit–III

Applications of Microcontrollers

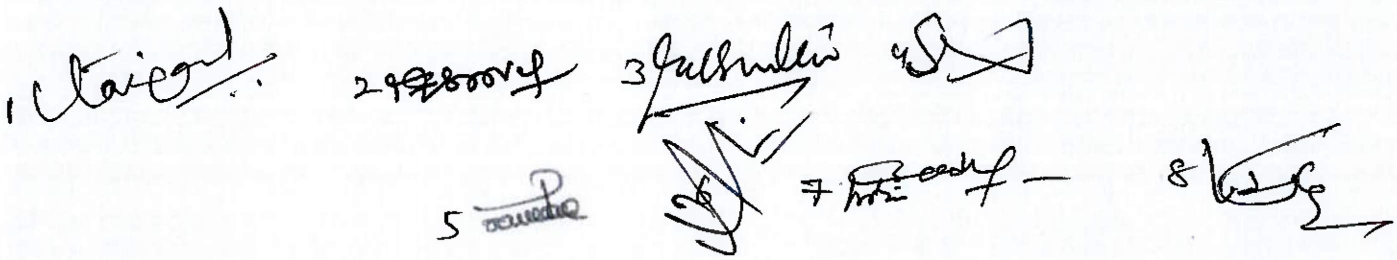
Interfacing of - Light Emitting Diodes (LEDs), Push Buttons, Relays and Latches.
Interfacingof-Keyboard,7-SegmentDisplays,LCD Interfacing, ADC and DAC with 89C51Microcontrollers.

Measurement Applications of–Robot Arm, LVDT and Strain Gauges

Automation and Control Applications of – PID Controllers, DC Motors and Stepper Motors.

Recommended Books:

1. Microcontrollers –Theory and Applications –By Ajay V Deshmukh, TMH, 2005
2. The 8051 Microcontrollers and Embedded Systems –By Muhammad Ali Mazidi and Janice GillispieMazidi, Pearson Education Asia, 4th Reprint, 2002
3. The 8051 Microcontroller - architecture, programming & applications –By Kenneth J. Ayala, Penram International Publishing, 1995.
4. Microcontroller 8051 by D. KarunaSagar, Narosa Publishing House, New Delhi, 2011.
5. Design with PIC Microcontrollers - By J B Peatman, MH, Pearson Education Asia, 2003.



DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc.(Physics)-Semester-III Syllabus (Nano Science)

(For the batch admitted from 2023-2024 onwards)

Paper –III

Course Code	Course Title
PHY303T/NS	**SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS**

Course Objectives: This course enables the students:

COB1	Study the classification of nanomaterials.
COB2	Study the various synthesis methods of nanomatrials.
COB3	Understand optical and thermal properties of nanomaterials.
COB4	Understand lithographic technique used in nanomaterials.
COB5	Study various characterization techniques for nanomaterials.

Course Outcomes: After the completion of this course the student will be:

COC1	Able to demonstrate the concepts of nano structured materials, their size dependent properties, various examples in zero, one, two and three dimensions
COC2	Able to synthesize various routes which could be bottom-up and top-down approaches.
COC3	Able to develop skills in the preparation of nanomaterials by Physical and Chemical methods
COC4	Able to compare the lithographic techniques for the nanomaterial fabrication with the other techniques.
COC5	Able to use the knowledge of characterization techniques which include X-ray diffractometry and spectroscopy for studying more novel materials.

Unit–I

Propertiesofnanomaterials:

Classification of Nano structured materials , density of states for0D,1D,2D and 3D ,nanoparticles, nano-wires, nano-clusters, quantum wells -Size dependent properties of nanomaterials – optical and thermal properties

Synthesis of nanomaterials-I

Synthesisroutes:Bottom–UpApproaches,Top–DownApproaches,consolidationofNanopowders

Physical methods: Inert gas condensation, Arc discharge, RF Plasma, plasma organic spraying sputtering and thermal evaporation, laser pyrolysis, ball milling, molecular beam epitaxy, chemical vapour deposition method, electro deposition.

Unit–II

Synthesisofnanomaterials-II

Chemical methods: chemical nucleation theory for cluster formation, metal nanocrystal synthesis by reduction, solvo-thermal synthesis, photochemical synthesis, electrochemical synthesis, sonochemical routes, liquid-liquid interface , hybrid methods, solvated metal atom dispersion, sol-gel, micelles and micro-emulsion technology.

Lithographic techniques:AFM based nanolithography, e-beam lithography and SEM based nanolithography, ion beam lithography, deep UV lithography, X-ray based lithography.

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Unit-III

Characterization methods: **Electron Microscopy**: Introduction,WorkingofSEM,TEM,AFM,applications.

X-ray Crystallography: Introduction, Structure of nano materials, X-ray diffraction (XRD) ,The powdermethod- Determination of grain size/crystallite using Scherrer's formula, Determination of Crystallite size distribution, Small angle X-ray scattering (SAXS).

Spectroscopy Techniques: Introduction, Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, DSC, UV visible spectroscopy.

Recommended Books:

1. Textbook of Nanoscience and Nanotechnology-B.S.Murty, P.Shankar, BaldevRaj, BBRath and James Murday Universities press,IIM, Metallurgy and Materials Science
2. Principles of Nanoscience&Nanotechnology M.A.Shah, Tokeer Ahmad, Narosa Publishing House.
3. Nanocrystals: Synthesis ,Properties and Applications C.N.Rao,P.J.Thomas,G.U.Kulkarni.
4. Springer Handbook of Nanotechnology – Bharat Bhushan.
5. Nano materials Handbook – YuryGogotsi.

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - Semester-III Syllabus (Nano Science)

(For the batch admitted from 2023 2024 onwards)

Paper–IV

Course Code	Course Title
PHY304T/NS	**PROPERTIESOFNANOMATERIALS**

Course Objectives: This course enables the students:

COB1	Understand the electronic properties of nanomaterials.
COB2	Study the dielectric properties of nanomatrials.
COB3	Understand optical and thermal and mechanical properties of nanomaterials.
COB4	Understand concept of phonons in nanomaterials.
COB5	Study about magnetic nanofluids.

Course Outcomes: After the completion of this course the student will be:

COC1	Able to identify the nanocomposites, nanofillers, their classification, properties and applications.
COC2	Able to develop skills in the preparation of nanocomposites such as polymer nanocomposites by Physical and Chemical methods.
COC3	Able to use the knowledge of synthesis techniques for studying more novel materials and apply in daily life or further research.
COC4	Able to analyze the mechanical properties of nanocomposites in general and also while they are used in devices.
COC5	Able to use the knowledge of characterization techniques which include X-ray diffractometry and spectroscopy for studying more novel materials.

Unit-I

Electronic properties: Classification of materials - metal, semiconductor, insulator-bandstructures, brillouin zones, mobility, resistivity, relaxation time, recombination centers, Hall effects, Confinement and transport in nanostructures: current , reservoirs and electron channels, conductance, local density of states, ballistic transport, Hopping transport, coulomb blockade, diffusive transport and Fock space.

Unit-II

Dielectricandmagneticproperties: Dielectricproperties:Polarization,Clausius-Mossottirelation,Debye's equations, ferroelectric behavior, Curie Weiss law, Polarons, Dielectric nanofluids and applications.

Magnetic properties: different kinds of magnetism in nature: dia, para, ferro, antiferro, ferri, superpara, and important properties in relation to nanomagnetism, magnetic nanofluids-characteristics and applications.

Unit-III

Optical, thermal and Mechanical properties:

Optical properties: photoconductivity, optical absorption & transmission, energy gap determination, photoluminescence, phosphorescence, electroluminescence.

Thermal properties: concept of phonons,therma lconductivity, specificheat, exothermic & endothermic processes.

Mechanical properties: tensile testing and tensile strength, breaking strength, plastic deformation, statistical analysis of failure data, true stress and strain, bend testing flexural strength and modulus, Brinell's, Viker's hardness-testing, impact testing –toughness, resilience and scratch test.

Recommended Books:

1. Textbook of Nanoscience and Nanotechnology-B.S.Murty, P.Shankar, BaldevRaj, BBRath and James Murday Universities press, IIM, Metallurgy and Materials Science
2. Principles of Nanoscience&Nanotechnology M.A.Shah, Tokeer Ahmad, Narosa Publishing House
3. Nanocrystals: Synthesis ,Properties and Applications C.N.Rao,P.J.Thomas,G.U.Kulkarni
4. Springer Handbook of Nanotechnology –Bharat Bhushan
5. Nano materials Handbook – YuryGogotsi
6. Introduction to Nano science and Nano technology – K KChatopadhayya&Banerjee,PHI
7. Introduction of Nano technology-CahrlesP.PooleJr and Franks J.Qwens
8. Physics of Magnetism-S.Chikazmi and S.H.Charap
9. Encyclopedia of Nanotechnology–Hari Singh Nalwa

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY,
REVISED SYLLABUS FOR M.Sc.(PHYSICS)
IV SEMESTER
With effect from the academic year 2023-2024 onwards

S. No	Paper code	Paper	Paper title	Instructions Hrs / Week (L+CCE)*	Credits	Max Marks
1.	PHY401T	Paper-I	Nuclear Physics	3+2	3	100
2	PHY402T	Paper-II	Spectroscopy	3+2	3	100
Solid State Physics (SSP)						
3	PHY403T/SSP	Paper-III	Optical Phenomena in solids	3+2	3	100
4	PHY404T/SSP	Paper-IV	Studies On Reduced Dimensionality In Solids Or Project	3+2	3	100
Electronics & Instrumentation (E&I)						
5	PHY403T/EI	Paper-III	Instrumentation for measurement and data transmission	3+2	3	100
6	PHY404T/EI	Paper-IV	PC Architecture Or Project	3+2	3	100
Nano Science (NS)						
7	PHY403T/NS	Paper-III	Nanocomposites	3+2	3	100
8	PHY404T/NS	Paper-IV	Nano Sensors And Nano Devices Or Project	3+2	3	100
PRACTICALS						
9	PHY405P	Paper- V	Modern Physics Lab-II	4	2	50
10	PHY406P	Paper- VI	Nuclear Physics Lab - II	4	2	50
11	PHY407P/SSP or PHY407P/EI or PHY407P/NS	Paper-VII	Solid State lab –III Or Electronics and Instrumentation Lab – III Or Nano Science Lab – III	4	2	50
12	PHY408P/SSP or PHY408P/EI or PHY408P/NS	Paper-VIII	Solid State lab –IV Or Electronics and Instrumentation Lab – IV Or Nano Science Lab – IV	4	2	50
		Total		28 + 8	20	600

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Details of credits and marks	
Number of instruction hours per each theory paper per week	3 +2
Maximum marks for each theory paper	100(60semesterexam+40 internal evaluation)
Number of credits for each theory paper	3
Number of instruction hours per each practical paper per week	4
Maximum Marks per each practical paper	50
Number of credits per practical paper	2
Number of Practical Papers	4
Project or Elective Paper -IV with marks (Report + Viva Voce)	60+40
Total Credits per semester	20

L* – Lecture; CCE* – Comprehensive Continuous Evaluation

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY
M.Sc. (Physics) - Semester-IV Syllabus
(For the batch admitted from2023-2024onwards)

Paper-I (Common for all Specializations)

Course Code	Course Title
PHY401T	**NUCLEAR PHYSICS**

Course Objectives This course enables the students:

COB1	Understand the concept of nuclear forces.
COB2	Study the nuclear models and its magnetic moments.
COB3	Understand nuclear decay and nuclear detection.
COB4	Understand concept of interaction of charged particles with matter.
COB5	Understand applications of nuclear physics.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Demonstrate the concepts of nuclear force, nuclear decay processes, detection mechanism and reactions.
COC2	Analyze the Deuteron problem, exchange force theories, a-decay, ß-decay, Bethe's formula Photoelectric effect, Compton effect and pair production.
COC3	Understand the neutrino hypothesis, Bohr's theory, working of gamma ray detectors, kinematics of nuclear reactions, nuclear reactors.
COC4	Evaluate the importance of knowledge of handling radioactive materials for various applications in day to day life like food irradiation, radiation therapy and diagnosis.
COC5	Develop skills in critical thinking and problem-solving and apply them effectively in both academic and professional contexts.

Unit I:

Nuclear Forces: Systematic 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.

Nuclear Models: 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 quadruple moments.

Unit II:

Nuclear Decay: α-decay, Gamow's theory, fine structure of α-spectrum, alpha decay, systematics, neutrino of hypothesis, Fermi's theory of β-decay, Fermi-Curie plot, angular momentum, selection rules for β-decay,

Nuclear Detection: Interaction of charged particles with matter, Bohr's theory, Bethe's formula. Range-energy relation, Stopping power, Measurements of range and stopping power.

Unit III:

Nuclear Reactions: Classification of nuclear reactions, Kinematics and Q-value of reactions; Basic theory of direct nuclear reactions-Born approximation, stripping and pick-up reactions, Compound nucleus formation; Theory of Fission and fusion reactions. Nuclear Reactors: Fission reactors- fusion reactors -

Particle Physics: Elementary Particles, Classification and their Quantum Numbers (Charge, Spin, iso-spin etc.). Fundamental forces, Conservation of Parity, Strangeness and Lepton and Baryon numbers,

Applications of Nuclear Physics: Food irradiation, Medical physics- radiation therapy - radiation dosimetry, radioactive tracers, Tomography (PET)

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 DC
8. John Lilley, Nuclear Physics: Principles and Applications, Wiley (2001)

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - Semester-IV Syllabus

(For the batch admitted from2023-2024onwards)

Paper–II (Common for all Specializations)

Course Code	Course Title
PHY402T	**SPECTROSCOPY**

Course Objectives: This course enables the students:

COB1	Understand the concept of atomic and molecular spectra.
COB2	Study the spin-orbit interaction.
COB3	Understand Raman and IR spectra.
COB4	Understand concept of nuclear spin and magnetic moment.
COB5	Understand ESR instrumentation and applications.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Determine the spectroscopic terms for equivalent and non-equivalent electron atom.
COC2	Analyze the hyperfine splitting of spectral lines.
COC3	Understand the nuclear spin and magnetic moment, origin of nuclear magnetic resonance.
COC4	Evaluate the vibrational and rotational Raman spectra.
COC5	Develop skills in estimating the hyperfine structure of ESR absorptions.

Unit I

Atomic Spectra: Different series in alkali spectra (main features), Ritz combination principle, L-S and j-j coupling; Spectroscopic terms for equivalent and non-equivalent electron atom- Energy level diagrams- Spin-Orbit interaction, doublet structure in alkali spectra, selection rules, intensity rules, alkali-like spectra, Lamb shift, isotope shift; hyperfine splitting of spectral lines, Lande interval rule.

Unit II

Molecular Spectra: Types of Molecular spectra, Salient features of rotational spectra, rotational spectra of diatomic molecule as a rigid rotator and a non-rigid rotator, effect of isotopic substitution on rotational spectra, salient features of Vibrational-Rotational spectra, vibrating diatomic molecule as a harmonic oscillator and as anharmonic oscillator.

Raman and Infrared (IR) Spectra: Raman effect, classical and quantum theory of Ramaneffect, normal vibrations of CO_2 and H_2O molecules, vibrational and rotational Raman spectra. Basic concept of IR spectroscopy –IR spectrophotometer –Principle and Instrumentation, FTIR principle and working.

Unit III:

Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) Spectroscopy: Nuclear spin and magnetic moment, origin of nuclear magnetic resonance(NMR) spectra, Theory ofNMRspectra,relaxationprocess–Blochequations–chemicalshift,experimentalstudyof

NMR spectroscopy, Experimental technique, ESR spectroscopy, origin and resonance condition, hyperfine structure of ESR absorptions, fine structure in ESR spectra, ESR instrumentation, Applications of ESR.

Books Recommended

1. Elements of Spectroscopy - Gupta, Kumar, Sharma
2. Atomic Spectra & Atomic Structure - Gerhard Hertzberg
3. Introduction to Molecular Spectroscopy - G.M.Barrow
4. Molecular Spectroscopy - J.D.Graybeal
5. Atomic and Molecular Spectroscopy - Raj Kumar
6. Molecular Structure & Spectroscopy - G.Aruldhas
7. Introduction to Atomic Spectra - H.E.white
8. Fundamentals of Molecular Spectroscopy - C.N. Banwell and EM Mc Ca
9. Spectra of Diatomic Molecules - Herzberg
10. Spectroscopy Vol. I, II, III - Walker and Straughen
11. Principles of Magnetic Resonance - C.P.Slitcher
12. Electron Spin Resonance: Their Applications - Wertz and Bolton

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc. (Physics) - Semester-IV Syllabus (SSP)

(For the batch admitted from 2023-2024 onwards)

Paper–III

Course Code	Course Title
PHY403T/SSP	**OPTICAL PHENOMENA IN SOLIDS**

Course Objectives: This course enables the students:

COB1	Understand the concept of optical properties of solids.
COB2	Study the direct and indirect band gap semiconductors.
COB3	Understand absorption and emission processes of luminescence.
COB4	Understand concept of quantum efficiency & frequency response of photo diodes.
COB5	Understand semiconductor materials for fabrication of homo junction solar cells.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Determine the photon-phonon transitions and inter band transitions.
COC2	Analyze the radiative and non radiative processes and decay mechanisms.
COC3	Understand the different kinds of color centers in the context of luminescence in alkali halides.
COC4	Evaluate different kinds of luminescence.
COC5	Develop skills in estimating the Fill factor, conversion efficiency, quantum efficiency of solar cells.

Unit I: Optical Properties of Solids

Relation between dielectric and optical properties (macroscopic theory), Kramer-Kronig relations, Absorption of electromagnetic radiation, Inter band transitions, Direct and indirect band gapcoefficients. Frenkel and Wannier excitons and their absorption, Imperfections - exciton absorption below the band gap, Intra-band transitions - Absorption and reflection in metals, Hagen-Rubens relation, Raman, Brillouin and Rayleigh scattering, Magneto-optic effects: Faraday effect.

Unit II: Luminescence

General considerations of luminescence, exciton, absorption and emission processes of luminescence, Configuration coordinate diagram, Energy level diagram, radiative and non-radiative processes, Decay mechanisms, Effect of doping and efficiency, Energy transfer and charge transfer, Different kinds of luminescence, Electro luminescence- Photoluminescence and Thermo-luminescence, Defects and color centers, Different kinds of color centers in the context of luminescence in alkali halides, Thallium activated alkali halides.

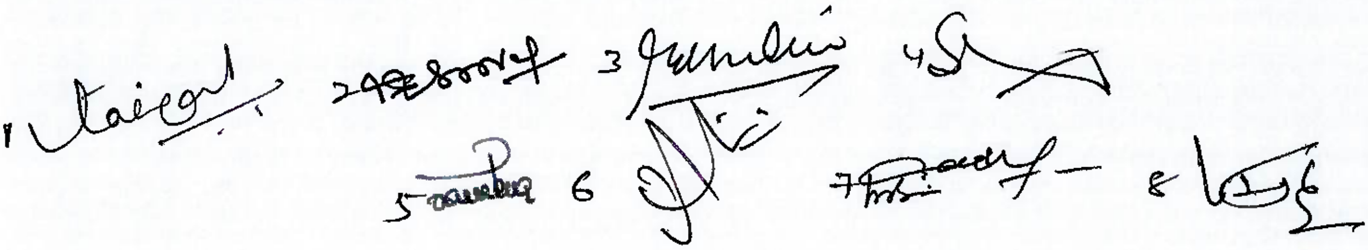
Unit III: Photo-detectors and Photo- voltaic

Photovoltaic effect, Types of interfaces, homo junction, hetero junction and Schottky barrier- Choice of semiconductor materials for fabrication of homo junction solar cells, equivalent circuit of a solar cell, Solar cell output parameters – Fill factor, conversion efficiency, quantum efficiency, effect of series and shunt resistance on the efficiency of solar cells.Photoconductors-dc and ac photoconductors, gain&

bandwidth, PIN diodes.

References:

1. Solar cells – Charles E. Backus, IEEE Press.
2. Fundamentals of Solar cells, Farenbruch and Bube.
3. Principles of theory of solids – Ziman, Vikas Publishing House, New Delhi.
4. Solid State Physics – G. Burns
5. Luminescence and Luminescent Materials – Blasse
6. Solid State Physics – Dekker.
7. Optoelectronic devices _ P. Bhattacharya
8. Physics of semiconductor devices – S. M. Sze.
9. Elementary solid state physics – M. Ali Omar



DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY
M.Sc. (Physics) - IV Semester Syllabus (SSP)
(For the batch admitted from 2023-2024 onwards)

Paper-IV

Course Code	Course Title
PHY404T/EI	**STUDIES ON REDUCED DIMENSIONALITY IN SOLIDS**

Course Objectives: This course enables the students:

COB1	To understand super lattice structure in semiconductors.
COB2	To study nano materials of zero and one dimensional structured materials.
COB3	To study various techniques to prepare thin films.
COB4	To study mechanism of conduction in metal insulator contacts.
COB5	To understand the mechanism of photoconduction in photovoltaic devices.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Student can acquire knowledge on super lattice structure in doped and pure semiconductors.
COC2	Students gain knowledge on zero dimensional materials like fullerenes, quantum dots and one dimensional materials nano wires and nanotubes.
COC3	Student will acquire knowledge on preparation of thin films using different techniques.
COC4	Gain knowledge on conduction mechanism in metal insulator contacts.
COC5	Mechanism of electron and hole movement due to photon of photoconduction in photovoltaic devices.

Unit I

Two Dimensional Solids - Quantum-Well Device Structures

A review of quantum mechanics - infinite deep rectangular potential well, Introduction to Semiconductor hetero-junction super lattices, Negative differential conductivity, Modulation doped hetero-junction super lattices - n-i-p-i structures.

One and Zero Dimensional Solids

Definitions, Zero-dimensional systems, Fullerenes, Quantum dots and their optical and electronic properties; One-dimensional systems: one-dimensional metals, Nano-tubes, Quantum wires (elementary treatment only)

Unit II

Preparation of Thin Films

Vacuum evaporation: Types of evaporation sources – Resistive heating, electron beam evaporation, Laser ablation, Epitaxial deposition: Vapor-phase epitaxy, Liquid-phase epitaxy, Sputtering : Glow discharge, Reactive sputtering, magnetron sputtering, Ion beam deposition. Chemical methods: Chemical Vapor deposition (CVD), Metal organic chemical vapor deposition (MOCVD).

Unit III

Insulator Thin Films

Metal insulator contact-Mott-Gurney contact- Schottky contact- Conduction in insulator films-Schottky emission-Poole-Frenkel emission-Thermally activated hopping-Direct tunneling-Space charge limited current-Photo conduction-Photovoltaic effect-Voltage controlled negative resistance-Experimental techniques for photo conduction.

Recommended Books:

1. Fundamentals of thin films - Goswamy
2. Thin films - K.L.Chopra
3. Semiconductor Devices - Physics and Technology - S.M.Sze
4. Hand book of nanostructred materials and nanotechnology (Vol. 1-4) Ed. By Hari Singh Nalwa
5. Nano crystalline materials – H. Gleiter
6. Nanophase materials - R.W. Seigel
7. Solid State Physics – G.Burns
8. Physics and Chemistry of Solids - S.R. Elliott
9. Non-Conventional energy sources, B.H. Khan, Tata Mc Graw-Hill, 2006
10. Non-Conventional energy sources, G.D. Rai, Khanna Publishers, 4th Edn, 2000.

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY
M.Sc. (Physics) - IV Semester Syllabus (E&I)
(For the batch admitted from 2023-2024 onwards)

Paper-III

Course Code	Course Title
PHY403T/EI	**INTRUMENTATION FOR MEASUREMENT AND DATA TRANSMISSION**

Course Objectives: This course enables the students:

COB1	Understand the classification of transducers.
COB2	Study the displacement, strain and pressure measurement.
COB3	Understand temperature sensors.
COB4	Understand concept of flow measurement.
COB5	Understand the methods of data transmission.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Explain the functionality of various transducers.
COC2	Compare the various temperature measuring devices.
COC3	Evaluate the ultrasonic flow meter.
COC4	Explain interfacing transducers to electronic control and measuring systems
COC5	Appreciate the multiplexing in telemetering system.

Unit I
Transducers: Classification of transducers–Active and Passive transducers- Electrical transducers- Displacement transducers -Digital transducers -Basic requirement of a transducer, **Displacement Measurement:** Variable resistance devices–Variable inductance devices -Variable capacitance devices.
Strain Measurement: Theory of operation of strain gauge–Types of strain gauges–Straingauge circuits - Full bridge.
Pressure Measurement: Bourdon Tube- Bellows - Potentiometer device- Strain gauge transducer –LVDT type transducer.

Unit II
Temperature Measurement: Classification of temperature measuring devices-Resistance type temperature sensors (platinum resistance thermometer, thermistors) –Resistance thermometer circuits- Thermocouples-Temperature Control-Liquid level control.
Flow Measurement: Classification of flow meters–Head type flow meters-–Ultrasonic flow meter- DC and AC Servomotors-Stepper motor.

Unit III
Data Transmission and Telemetry:
Analog and Digital Data Acquisition Systems: Interfacing transducers to electronic control and measuring systems – IEEE 488 Bus.

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Methods of data transmission–General telemetry system-Functional blocks of telemetry system – Types of telemetry systems–Land line telemetering system-Voltage telemetering systems–Current telemetering system-Position telemetering system– Land line telemetry–Multiplexing in telemetering system.

Recommended Books:

1. Modern Electronic Instrumentation and Measurement Techniques –A.O.Helfrick and W.D.Cooper, Prentice Hall India Publications.
2. Instrumentation Devices and Systems- C.S.Rangan, G.R. Sharma and VSV Mani, Tata Mc.Graw Hill Publications.
3. Introduction to instrumentation and Control- A.K.Ghosh –Prentice Hall India Publications.
4. Electrical and Electronics Measurement and Instrumentation –A.K.Sawhney.
5. Transducers and Instrumentation –DVS Murthy, PHI Publications.

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY
M.Sc. (Physics) –IV Semester Syllabus (E&I)
(For the batch admitted from 2023-2024 onwards)

Paper-IV

Course Code	Course Title
PHY404T/EI	**PC ARCHITECTURE**

Course Objectives: This course enables the students:

COB1	To study the Basics of Computer architecture and organization.
COB2	To learn the assembly language programming.
COB3	To learn about the central processing unit and its function.
COB4	To learn the arithmetic operations in computer.
COB5	To study about Input and output organization.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Basics of Computer architecture and organization
COC2	Able to write assembly language programming
COC3	Acquire knowledge about the central processing unit and its function in computer.
COC4	Process of arithmetic operations in computer
COC5	Get knowledge of interfacing devices to computer for input and output organization

Unit I
Basic Computer organization: Instruction codes, computer instructions , timing and control, memory referred instructions , I/O and interrupts , complete computer description and design.
Programming the computer: Assembly language, assembler, program loops, arithmetic and logical operations, subroutines and I/O programming.
Microprogrammed control : Control memory, address sequencing and microprogram examples.

Unit III
Central Processing Unit: Introduction to CPU, general register organization, stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control and RISC.
Computer Arithmetic – I : Addition and subtraction Multiplication algorithms, Division algorithms.

Unit IV

Computer Arithmetic – II : Floating point Arithmetic Operations, Decimal arithmetic Unit, and Decimal Arithmetic Operations.
Input –Output organization: Peripheral Devices, Input –Output Interface, Asynchronous Data transfer, Modes of transfer, Priority Interrupt, Direct Memory Access (DMA), Inapt-Output processor (IOP), Serial Communication.

Reference books :

1. Computer Fundamentals ,Architecture and Organization -- B.Ram 3rd Edn. New Age International.
2. Computer System architecture . -- Moris mano , PHI (2000)
3. An introduction to digital computer design -- V.Rajaraman and T.Radhakrishna
4. Computer Architecture and parallel processing -- k.Hang and F.A bigg , Mcgraw –Hill
5. Computer Architecture and logic design -- Thomas C.Bartee , Mcgraw –Hill

DEPARTMENT OF PHYSICS, PALAMURU UNIVERSITY

M.Sc.(Physics)-Semester-IV-Syllabus(Nano Science)

(For the batch admitted from 2023-2024 onwards)

Paper –III

Course Code	Course Title
PHY403T/NS	**NANOCOMPOSITES**

Course Objectives: This course enables the students:

COB1	Understand the concept of nuclear forces.
COB2	Study the nuclear models and its magnetic moments.
COB3	Understand nuclear decay and nuclear detection.
COB4	Understand concept of interaction of charged particles with matter.
COB5	Understand applications of nuclear physics.

Course Outcomes: After the completion of this course the student will be able to:

COC1	Explain the functionality of various transducers.
COC2	Compare the various temperature measuring devices.
COC3	Evaluate the ultrasonic flow meter.
COC4	Explain interfacing transducers to electronic control and measuring systems
COC5	Appreciate the multiplexing in telemetering system.

Unit-I: Introduction: Nanocomposites, nanofillers, classification of nanofillers, carbon and non-carbon based nanofillers-synthesis and properties of fillers, Nano composites containing functionalized nanoparticles :organic and polymer materials for light –emitting diodes,

Polymer nanocomposites: Nanotube /polymer composites, layered filler polymer composite processing – polyamide matrices, polyimide matrices, polypropylene and polyethylene, matrices, liquid –crystalmatrices, Epoxy and polyurethane matrices and rubber matrices,photo-oxidation of light emitting polymers, nanoparticles approaches to enhance the lifetime of emitting polymers. (15)

Unit-II: Synthesis ofNanocomposites: Direct Mixing ,Solution Mixing, In –Situ Polymerization, In-Situ Particle processing ceramic / polymer composites, In-Situ particle processing, metal / polymer nanocomposites, modification of interfaces, modification of nanotubes, modification of nanoparticles, wear resisting polymer nanocomposites: preparation and properties, surface treatment, composites manufacturing, wear performance and mechanism. (15)

Unit-III: Mechanical Properties of Nanocomposites : modulus and the Load –Carrying , capability of nanofillers, failure stress and strain Toughness, glass Transition and Relaxation Behavior, abrasion and wear resistance , permeability , dimensional stability constants, thermal stability and flammability, electrical and optical properties, resistivity, permittivity, and breakdown strength, refractive index, light emitting devices.(15)

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Reference Books:

1. Encyclopedia of Nanotechnology –Hari Singh Nalwa
2. Springer Handbook of Nanotechnology – Bharat Bhushan
3. Handbook of Semiconductor Nanostructures and Nanodevices,Vol1-5-ABalndin,K.L Wang.
4. Nanostructures and Nanomaterials- Synthesis, Properties and Applications –Cao,Guozho

and characterization of sensors, Sensors for aerospace and defense. Organic and inorganic nanosensors.

NEMS: Inertial sensors –accelerometer-gyroscope –micromechanical pressure sensors-piezo-resistive –capacitors –micro robotics –optical MEMS-Visual display –precision optical platform –optical data switching- RF MEMS-MEMS variable capacitors –MEMS switches –resonators.

Reference Books:

1. Nanoelectronics and Nanosystems –From Transistors to Molecular Quantum Devices K.Goser, P.Glosekottter and J.Dienstuhl , springer,2004.
2. NanoPhotonics Herve Rigneault ,Jean –Michel Lourtioz, Claude Delalande ,Ariel Levenson.
3. Nanotechnolgy and Nanoelectronics- Materials, Devices and Measurement Techniques W.R.Fahrner Springer ,2006.
4. Sensors: Micro& Nanosensors,Sensor Market trends (Part1&2) H.Meixner
5. Nanoscience & technology :Novel structure and Phenomena Ping Sheng(Editor)
6. MEMS & Microsystems Design and Manufacture Tai-Ran Hsu Tata McGraw –Hill
7. MEMS and MOEMS technology and applications PHI Learning private Ltd.2009
8. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester, 2002.
9. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.
10. . Nanomaterials for Biosensors, Cs. Kumar, Wiley – VCH, 2007.
11. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006. nit-III
12. MS Handbook Mohammed Gad-el-Hak CRC Press 2002.

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and characterization of sensors, Sensors for aerospace and defense. Organic and inorganic nanosensors.

NEMS: Inertial sensors –accelerometer-gyroscope –micromechanical pressure sensors-piezo-resistive –capacitors –micro robotics –optical MEMS-Visual display –precision optical platform –optical data switching- RF MEMS-MEMS variable capacitors –MEMS switches –resonators.

Reference Books:

1. Nanoelectronics and Nanosystems –From Transistors to Molecular Quantum Devices K.Goser, P.Glosekottter and J.Dienstuhl , springer,2004.
2. NanoPhotonics Herve Rigneault ,Jean –Michel Lourtioz, Claude Delalande ,Ariel Levenson.
3. Nanotechnolgy and Nanoelectronics- Materials, Devices and Measurement Techniques W.R.Fahrner Springer ,2006.
4. Sensors: Micro& Nanosensors,Sensor Market trends (Part1&2) H.Meixner
5. Nanoscience & technology :Novel structure and Phenomena Ping Sheng(Editor)
6. MEMS & Microsystems Design and Manufacture Tai-Ran Hsu Tata McGraw –Hill
7. MEMS and MOEMS technology and applications PHI Learning private Ltd.2009
8. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester, 2002.
9. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.
10. . Nanomaterials for Biosensors, Cs. Kumar, Wiley – VCH, 2007.
11. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006. nit-III
12. MS Handbook Mohammed Gad-el-Hak CRC Press 2002.

LIST OF EXPERIMENTS IN GENERAL PHYSICS LAB

Paper V

MODERN PHYSICS - SPECTROSCOPY LAB

III & IV Semester

1 Zeeman effect.

2 Raman effect.

3 Magnetic susceptibility of a paramagnetic liquid.

4 Verification of Beer's law.

5 Temperature variation of resistance/conductivity of a given material –two probe method.

6 Hall effect.

7 Curie temperature of PZT.

8 Powder X-ray diffraction method for Crystal Structure determination

9 Atomic Spectra

NUCLEAR PHYSICS LABORATORY

III & IV Semesters

Paper VI

1. To draw the characteristic curve of the given G.M. Detector and determine its plateau length and working potential.
2. To determine the dead time of a given G.M. tube using double source.
3. To determine the half life of a long lived radio active substance .
4. To determine the linear and mass absorption coefficients of β-particles in a given material, i.e. Al.
5. To determine the absorption coefficient of gamma rays in different absorbing materials, i.e., Al and Pb.
6. To determine the half life of irradiated Indium foil.
7. To determine the half life of short lived and long lived irradiated silver (Ag) foil.
8. To verify inverse square law using beta or gamma source.

SOLID STATE PHYSICS - PRACTICALS

III & IV Semester

Paper – VII & VIII

List of Experiments

1. Energy gap of a Semi Conductor by forward bias
2. Energy gap of a Semi Conductor by reverse bias
3. C-V Characteristics of a p-n junction diode
4. Determination of activation energy of a metallic film, by four probe method

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5. characteristics of a solar cell and determination of power gradient and efficiency
6. Thermo electric power of a semi conducting material
7. Determination of Lande factor – ESR Spectrometer
8. Magnetic Susceptibility of a paramagnetic salt-Guoy's balance method
9. Determination of magnetic transition temperature and permeability of ferro magnet.
10. Variation of manetoresistance with magnetic field and temperature by four probe method
11. Determination of lattice parameter of a fcc crystal usind XRD pattern
12. Study of lattice vibrational Spectra.
13. Determination of ferro electric transition of a PZT material.
14. Determination of magnetic transition temperature B-H curve method.
15. Determination of activation energy of defects in semi conductors at low temperatures(77-300k)
16. Dipole method of a organic molecule(Acetone)
17. Dielectric constant of a non polar liquid.
18. Calibration of a Si diode and a copper thermocouple as temperature sensors.
19. Verification of curie-weiss law for the electrical susceptibility of a ferroelectric material.
20. Determination of Transition temperature of a Superconductor

ELECTRONICS INSTRUMENTATION- PRACTICALS

III & IV Semester
Paper – VII & VIII
Analog, Digital & Simulation Lab

(A1) Analog Experiments :

1. Power control by SCR using UJT.
2. PLL (IC 565) as FM Detector.
3. Active filters.
4. PLL (IC565) as frequency synthesizer.
5. Strain guage –Trainer kit.
6. LVDT -Trainer kit.
7. PLL (IC 565) as AM detector.

(A2) Analog Simulation Experiments

8. Active filters Using Op-Amps
9. Frequency Modulation and detection
10. Amplitude modulation and detection
11. Solution of differential equations using analog computation (Using TUTSIM)

(B) Digital experiments (Hardware and Simulation)

1. Construct a synchronous up/down counter using IC74192 and display count using 7-segment display.
2. Implement Boolean functions using a multiplexer.
3. Construct a shift register using IC 7495.
4. Construct an 8-bit full adder using two 4-bit adders.
5. Implement Boolean functions using Dec/D
6. Simulating a four variable Boolean function using a 1 of 16 data Sel/Mu
7. Given a four variable Boolean function design and simulate the circuit using gates.
8. Simulate a 4-bit Bin/BCD decade counter
9. Simulate a full adder circuit using a Dec/Dem
10. Simulate a 4-bit shift register.
11. Design a counter with skipped counts & simulate
12. Simulate a Johnson Counter

Microprocessors & Microcontrollers Lab
III & IV Semester
Paper – VII & VIII

Programming and Interfacing using Microprocessor (8086)

1. Addition of fifty 16-bit numbers stored in consecutive memory location
2. Divide a 28 bit unsigned number by 8 .
3. Convert a 2-digit unsigned BCD number to binary.
4. To add two words ,each word containing four packed BCD digits.
5. Write a subroutine ,to multiply a signed 16-bit number and a signed 8-bit number, that can be called by a main program in a different code segment and stores the result in consecutive memory locations.
6. Simple programs on PC using Macro Assembler MASM 86
7. To interface the analog-to-digital converter (ADC) kit with PC and to develop suitable programs to convert the analog signal into digital value.
8. To interface the digital-to analog converter (DAC) kit with PC and to develop suitable programs to generate various waveforms to display it on CRO.
9. To interface the given stepper motor and to develop suitable program to rotate it at various stepping angles

Experiments using Microcontroller (8051)

1. To test the 8051 system and its ports.
2. To interface an ADC to the 8051.
3. To program the 8051 timer. To generate a square wave using the 8051 timer.
4. To interface a DAC to the 8051. To generate a sine wave on the scope using the DAC.
5. To interface a DAC to the 8051. To generate a sine wave on the scope using the DAC.
6. To interface a stepper motor to the 8051.To write a program to control the angle and direction of stepper motor rotation by the user
7. To examine and use an 8051 Assembler. To examine and use an 8051 simulator

8. To code a program to add hex numbers. To code a program to add BCD numbers. To code a program to add two multi-byte BCD numbers.
9. To practice converting data from decimal to binary and hexadecimal systems.
10. To write a program to convert data from hex to ASCII. To write a program to find the average of a set of hex data. To examine the 8051 division and multiplication instructions.