PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
*Autonomous*
Siddhartha Nagar, Vijayawada–520010
*Re-accredited at 'A+' by the NAAC*

## Paper - 4:CONDENSEDMATTERPHYSICS–II

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| Offered to : M.Sc.(PHYSICS) | Course Code : 22PH4D3 |
| Course Type : Domain specific elective (DSE) | Course : Condensed Matter Physics – II (Special) |
| Year of Introduction : 2022 | Year of offering : 2023 |
| Year of Revision : 2022 | Percentage of Revision : Nil |
| Semester : IV | Credits : 4 |
| Hours Taught : 60 hrs. per Semester | Max.Time : 3 Hours |

**CourseDescriptionand Purpose:**

Condensed Matter Physics–II course will obtain a basic knowledge of the theory ofsuperconductors and the Josephson effect and their applications in cryoelectronics. The study of dielectricproperties concerns storage and dissipation of electric and magnetic energy in materials.

**Course Objectives:**

1. To understand the principles of some crystal growth techniques.
2. To understand the basic concepts of superconductivity
3. To understand the different phenomena where superconductivity is applied.
4. To understand the basic concepts of dielectrics
5. To understand the basic concepts of ferroelectrics.

**Course Outcomes:** At the end of this course, students should be able to:

CO1: Apply some crystal growth techniques to form crystals
CO2: Analyse the basic concepts of superconductivity
CO3: Analyse different phenomena involving superconductivity and their applications
CO4: Analyse the basics of dielectrics and their applications
CO5: Analyse the basics of ferroelectrics and their applications

| CO-POMATRIX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **CO-PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
| 22PH4D3 | **CO1** | H | | | | | L | M |
| | **CO2** | H | M | | | | L | M |
| | **CO3** | | H | | | | L | M |
| | **CO4** | | H | | | | L | M |
| | **CO5** | H | M | | | | L | M |

| Syllabus | | |
|---|---|---|
| **Unit** | **Learning Units** | **Lecture Hours** |
| I | **CrystalGrowthTechniques**<br>Bridgeman - Czochralski - Liquid Encapsulated Czochralski (LEC) growth techniques - zone refining andfloating zone growth - chemical vapour deposition (CVD) - Molecular beam epitaxy - vapourphaseepitaxy-hydrothermalgrowth- Growthfrommeltsolutions- Flamefusionmethod. | 12 |
| II | **Superconductivity-Introduction**<br>Meissnereffect, Isotope effect, specific heat, thermal conductivity and manifestation of energy gap,Londonequations,typeIandtypeIIsuperconductors,Quantumtunnelling, Cooperpairingduetophonons,BCStheoryofsuperconductivity. | 12 |
| III | **ApplicationsofSuperconductivity**<br>Ginzburg - Landau theory and application to Josephson effect - dc Josephson effect, ac Josephson effect,macroscopicquantuminterference,applicationsofsuperconductivity,hightemperaturesuperconductivity. | 12 |
| IV | **Dielectrics**<br>Introduction,Dipolemoment,Varioustypesofpolarization– Electronic,ionic,andorientationpolarization, Macroscopic description of the static dielectric constant, The internal field according toLorentz,Clausius-Mossottiequation,Thestaticdielectricconstantofsolids,Complexdielectricconstant, Frequency dependence of dielectric constant, Dielectric loss, Effect of temperature on dielectricconstant,Applicationsofdielectrics. | 12 |
| V | **Ferroelectrics**<br>Generalpropertiesofferroelectricmaterials.Classificationandpropertiesofrepresentativeferroelectrics - Dipole theory of ferroelectricity, objections against the dipole theory, Ionic displacements and thebehaviourofBaTiO3aboveCurietemperature,theoryofspontaneouspolarizationofBaTiO3,Ferroelectricdomains. | 12 |

**TextandReferenceBooks:**


1. SolidStatePhysics,A.J.DEKKER(Macmillan).
2. IntroductiontoSolidStatePhysics,CHARLES KITTEL(JohnWiley&Sons).
3. SolidStatePhysics,GUPTAandKUMAR (K.Nath&Co.).
4. SolidStatePhysics,S.O.Pillai(NewAgeInternational).