SRI A. S. N. M. GOVERNMENT COLLEGE (A), PALAKOL, W.G. DT (Affiliated to Adikavi Nannaya University, Rajamahendravaram) (Accredited with NAAC "B" Grade with 2.61 CGPA points) III B. Sc. Physics Semester-VI: Syllabus 2019-2020

<u>Department of Physics</u> Elective Paper-VII (B): Material science

3 Hour/Week Total Hours: 45

UNIT-I (9 hrs)

1. Materials and Crystal Bonding: Materials, Classification, Crystalline, Amorphous, Glasses; Metals, Alloys, Semiconductors, Polymers, Ceramics, Plastics, Bio-materials, Composites, Bulk and nanomaterials. Review of atomic structure – Interatomic forces – Different types of chemical bonds – Ioniccovalent bond or homopolar bond – Metallic bond – Dispersion bond – Dipole bond – Hydrogenbond – Binding energy of a crystal.

UNIT-II (9 hrs)

2. **Defects and Diffusion in Materials**: Introduction – Types of defects - Point defects- Line defects- Surface defects- Volume defects- Production and removal ofdefects- Deformation-irradiation- quenching- annealing- recovery - recrystallization and grain growth. Diffusion in solids- Fick's laws of diffusion.

UNIT-III(9 hrs)

3. **Mechanical Behavior of Materials**: Different mechanical properties of engineering materials – Creep – Fracture – Technologicalproperties – Factors affecting mechanical properties of a material – Heat treatment - Cold andhot working – Types of mechanical tests – Metal forming process – Powder – Misaligning – Deformation of metals.

UNIT-IV(9 hrs)

4. **Magnetic Materials**:Dia-, Para-, Ferri- and Ferromagnetic materials, Classical Langevin theory of dia magnetism, Quantum mechanical treatment of paramagnetism. Curie's law, Weiss's theory of ferromagnetism, Ferromagnetic domains.Discussion of B- H Curve.Hysteresis and energy Loss.

UNIT-V (9 hrs)

5. **Dielectric Materials**:Dielectric constant, dielectric strength and dielectric loss, polarizability, mechanism of polarization, factors affecting polarization, polarization curve and hysteresis loop, types of dielectric materials, applications; ferroelectric, piezoelectric and pyroelectric materials, Clausius -Mosotti equation.

Reference books

1. Materials Science by M.Arumugam, Anuradha Publishers. 1990, Kumbakonam.

- 2. Materials Science and Engineering V.Raghavan, Printice Hall India Ed. V 2004. New Delhi.
- 3. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- 4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications

Elective paper-VII (B)-Material science Practical: Minimum of 6 experiments to be done and recorded

3 Hour/Week

Total Hours: 45

- 1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
- 2. Measurement of magnetic susceptibility of solids.
- 3. Determination of coupling coefficient of a piezoelectric crystal.
- 4. Measurement of the dielectric constant of a dielectric Materials
- 5. Study the complex dielectric constant and plasma frequency of metal using surface plasmon resonance (SPR)
- 6. Study the hysteresis loop of a Ferroelectric Crystal.
- 7. Study the B-H curve of 'Fe' using solenoid and determine energy loss from hysteresis.

Practicals	50 marks	
Formula & Explanation	6	
Tabular form +graph +circuit diagram	6	
Observations	12	
Calculation, graph, precautions & Result	6	
Viva-Voce	10	
Record	10	

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III B.Sc. Physics Semester-VI Elective Paper –VII-(B): Material science

Module	Essay Questions 10 marks	Short Questions 5 marks	Marks allotted
1. UNIT-I	2	2	30
2. UNIT -II	2	2	30
3. UNIT -III	2	1	25
4. UNIT -IV	2	1	25
5. UNIT -V	2	1+1(Problem)	30
Total			140

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III B.Sc.: Physics Semester- VI (Model Paper)- (2018-20) Elective paper-VII (B)-Material science

Section-A

Answer ALL Question

5x10=50M

1. (a) Explain various types of bonds in crystals? Explain their properties?

(or)

- (b) Describe the classification of materials?
- 2. (a) Write about various types of crystals defectives?
 - (or) (b) Derive the expressions for the Schottky and Frankel defects?
- 3. (a) Write various mechanical properties of engineering materials?
 - (or)(b) Define Creep. Give an account on the various stages of Creep rate, the factors Influencing the Creep resistance?
- 4. (a) Describe Langevin's theory of diamagnetism?
 - (or) (b) Explain Weiss' theory of ferro magnetism?
- 5. (a) Discuss various types of dielectric material?

(or)

(b) What are ferro electric materials? Give properties and applications of ferro electric materials? Explain ferro electric hysteresis.

Section-B

Answer any FIVE of the following

- 6. What are ceramics? Give applications of ceramics?
- 7. What are nano materials? Give applications of nano technology?
- 8. Write short note on Quenching?
- 9. Explain diffusion in solid and Fick's law of diffusion?
- 10. Distinguish between brittle fracture and ductile fracture?
- 11. Write short note on magnetic domains?
- 12. Derive the Clasius Mosotti equation?
- 13. The dielectric constant of water is 78. Calculate its electrical permittivity and Susceptibility?