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Department of Physics
Minutes of BOS meeting

Type of meeting	Board of studies (BOS)
Department	Department of Physics, KLEF, Vaddeswaram 522 302, Guntur
Date	12th August 2025
Time	11:30 AM – 1:00 PM
Venue of meeting	**Optics Lab, Room No.: F202B (Hybrid mode)** Cisco WebEx virtual meeting (External BOS members & subject experts will join online) https://kluniversity.webex.com/kluniversity/j.php?MTID=mf01e1aa682e36a2e2408a67fdd5723ec

MEMBERS ATTENDED THE BOARD OF STUDIES MEETING, DEPARTMENT OF PHYSICS

S. No.	Name	Designation & Organization	Position in the BOS Meeting	Signature
1	Dr. K. Swapna	Associate Professor & HOD, KLEF	BOS-Chairperson	
2	Dr. M. Venkateswarlu	Assistant Professor & Dy. HOD & Prof. In-Charge (Academics)	BOS-Secretary	
3	Prof. D. Haranadh	Department of Physics National Institute of Technology-Warangal Warangal, Telangana. Mobile: 9958101115 Email: haranath@nitw.ac.in	External Member & Subject Expert	PRESENT
4	Dr. M. Mamatha Kumari	Assoc. Professor, Dept of Material Sci & Nanotech Yogi Vemana University, Kadapa 516005, AP. India. Mobile: 9966845899 mamathakumari@yogivemanauniversity.ac.in mamtha0823@gmail.com	External Member & Subject Expert	PRESENT
5	Dr. D. Amaranatha Reddy	Associate Professor Department of Sciences IIITDM-Kurnool, AP. Mobile: 9985577335 Email drreddy@iiitk.ac.in	External Member & Subject Expert	PRESENT
6	Dr. Balakrishnan Ramalingam	Researcher, Project Engineer Singapore University of Technology & Design (SUTD) SINGAPORE 487372 Mobile: +6583804054 Email:	External Member Subject & Industrial Expert	ABSENT

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		balakrishnan.sjc@gmail.com		
7	Dr. Suganya Sethu Narayanan	Managing Director, SIGETECH Embedded and Robotics Solutions Private Limited, Chennai Mobile: 9966845899 Email: suganyasethu17@gmail.com	External Member Subject & Industrial Expert	ABSENT
8	Dr. Hemachandra Rao Bitra	Assistant Professor, Department of Physics, Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous), Hyderabad, India Mobile: 9885681872 Email: hema1779@grietcollege.com	External Member & Alumni Expert	PRESENT
9	Dr B. Hima Bindu	Assistant Professor, Department of Physics, B. V. Raju Institute of Technology, Narsapur, Medak,Telangana Mobile: 8008886315 Email: bindu1024@gmail.com	External Member & Alumni Expert	PRESENT
10	Prof. B.V. Appa Rao	HOD-Mathematics, KLEF	Internal Subject Expert	
11	Dr. A. Venkateswara Rao	HOD-Chemistry, KLEF	Internal Subject Expert	
12	Dr. N. S. M. P. Latha Devi	Associate Professor, KLEF	Internal Member	12/8/25
13	Dr. G. Sunita Sundari	Associate Professor, KLEF	Internal Member	12/8/2025
14	Dr. Mahamuda Shaik	Associate Professor & RPAC, KLEF	Internal Member	12/8/25
15	Dr. K. Raghavendra Kumar	Associate Professor, KLEF	Internal Member	12/8/25
16	Dr. M V V K Srinivas Prasad	Assistant Professor & Asst. COE, KLEF	Internal Member	12/8/25
17	Dr. A Venkateswara Rao	Assistant Professor, KLEF	Internal Member	
18	Dr. Shaik Babu	Assistant Professor, KLEF	Internal Member	
19	Dr. M. Gnana Kiran	Assistant Professor, KLEF	Internal Member	
21	Dr. S. Shanmugan	Assistant Professor, KLEF	Internal Member	
22	Dr. Hushnud	Assistant Professor, KLEF	Internal Member	12/8/25
23	Ms. K. Sangeetha	Research Scholar, Dept of Physics, KLEF	Scholar Representative	
24	Ms. G. Dedeepya	Research Scholar, Dept of Physics, KLEF	Scholar Representative	
25	Ms. D. Naga Prasuna	Research Scholar, Dept of Physics, KLEF	Scholar Representative	

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KONERU LAKSHMAIAH EDUCATION FOUNDATION (KLEF)
(Deemed to be University)
DEPARTMENT OF PHYSICS, VADDESWARAM - 522302
AGENDA OF THE 10th BOARD OF STUDIES (BOS) MEETING – 2025
Date: 12th August 2025

Meeting Time: 11:30 AM – 1:00 PM

Venue: Optics Lab, Room: F202B (Hybrid Mode)

Cisco WebEx virtual meeting (External BOS members & subject experts will join online)
https://kluniversity.webex.com/kluniversity/j.php?MTID=mf01e1aa682e36a2e2408a67fdd5723ec

Contents

Item No.	Item Description
2.1	Grant of Leave of absence if any.
2.2	Agenda of Items in the 10th BOS meeting.
2.3	Follow-up actions on the minutes of previous BOS meetings.
2.4	Proposed to review and revision of the existing Pre-PhD curriculum, including additions and deletions of topics, for the AY 2025-26. Proposed for the inclusion of syllabi of newly introduced research course papers in the Pre-PhD curriculum for the AY 2025-26. As per the suggestions received from the Dean-R&D in association with the Office of Dean-Academics and IQAC, KLEF and the same resolutions are passed in the Department Academic Committee (DAC) meeting held on 5th August 2025 from 11:30 AM in the offline mode in Room: F202B.

Item 2.1

Grant of Leave of absence if any: NIL

The Head & BOS Chair, Department of Physics, KLEF formally welcomed all the members to the meeting of 10th Board of Studies and thereafter the agenda items are discussed and resolved for approval with the consideration from the external BOS members and subject experts as follows:

Item 2.2

Agenda items

1. To review and propose revisions to the existing Pre-PhD curriculum, including additions and deletions of topics, for the AY 2025-26.
2. To propose the inclusion of syllabi for newly introduced research papers in the Pre-PhD curriculum for the AY 2025-26.
3. Any other item with the permission of the BOS Chair.

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Resolution:

It is resolved and recommended with approval of the proposal for the revision of the existing Pre-PhD curriculum with additions and deletions of topics and inclusion of new research papers with their syllabi in Pre-PhD syllabus for the AY 2025-26 offered by the Department of Physics on the Department Academic Committee (DAC) meeting held on 5th August 2025 from 11:30 AM in the offline mode in Room: F202B.

Item 2.3

Follow-up actions on the Minutes of the previous 9th BOS meeting(s)

(Dr. K. Swapna, BOS Chairperson, Assoc Prof and HOD, Dept of Physics, KLEF, chaired meeting and briefed the agenda points for consideration of approval)

We strictly follow the resolutions passed in the previous minutes of the BOS meetings in all programs offered by the Department of Physics, KLEF.

Item 2.4

Agenda and Resolutions

BOS Chairperson presented the revised/updated Pre-PhD curriculum, with additions and deletions of topics, and inclusion of new research papers with their syllabi in Pre-PhD syllabus offered by the Department of Physics to be implemented for AY 2025-26 admitted batch students to all external and internal members of BOS. Upon due deliberation, the external members suggested for minor changes and given recommendations with their approval for the revised Pre-PhD curriculum presented in the 10th BOS meeting held on 12th August 2025 from 11:30 AM to 1:00 PM in Optics Lab (Room: F202B) (Hybrid Mode).

Agenda Point – 1

To review and propose revisions to the existing Pre-PhD curriculum, including additions and deletions of topics, for the AY 2025-26. (See Annexure – I)	**Approved the same in DAC and BOS and recommended for the approval in the Academic council**

Resolution – 1: It is resolved and approved in the 10th BOS meeting the proposed revision of the existing Pre-PhD curriculum with additions and deletions of topics considering the importance and advancement of research topics offered by the Department of Physics, KLEF by all the external and internal members. The same is permitted after taking recommendations from the external, internal, and other stakeholders (scholars, alumni, and others) of BOS for its inclusion from the AY 2025-26. The proposed revised version of Pre-PhD syllabus is shown in Annexure-I.

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List of following existing research courses which are proposed and discussed to implement the revision being conducted in the BOS meeting.

S.No.	Course Code	Course Title	LTPS	Credits
1	25PHY201	Spectroscopic Studies on Transition Metal Ions	4-0-0-0	4
2	25PHY203	Remote Sensing & Geospatial Analysis	4-0-0-0	4
3	25PHY205	Liquid Crystals-I	4-0-0-0	4
4	25PHY206	Physics of Solar Engineering	4-0-0-0	4
5	25PHY301	Spectroscopic Studies on Rare Earth Ions	4-0-0-0	4
6	25PHY302	Solid State Ionics	4-0-0-0	4
7	25PHY303	Upper Atmospheric Science	4-0-0-0	4
8	25PHY305	Liquid Crystals-II	4-0-0-0	4
9	25PHY306	Advanced Solar Energy Storage Technologies	4-0-0-0	4
10	25PHY307	Aeronomy	4-0-0-0	4
11	25PHY308	Thin Film Technology and Applications	4-0-0-0	4

Agenda Point – 2

To propose the inclusion of syllabi for newly introduced research papers in the Pre-PhD curriculum for the AY 2025-26. (See Annexure – II)	**Approved the same in DAC and BOS and recommended for the approval in the Academic council**

Resolution – 2: It is resolved and approved in the 10th BOS meeting the proposed new research papers with their syllabi for inclusion in the Pre-PhD curriculum offered by the Department of Physics, KLEF by all the external and internal members. The same is permitted after taking recommendations from the external, internal, and other stakeholders (scholars, alumni, and others) of BOS for its inclusion from the AY 2025-26. The proposed new research courses and their syllabi are shown in Annexure-II.

S.No.	Course Code	Course Title	LTPS	Credits
1	25PHY207	Particle Physics-I	4-0-0-0	4
2	25PHY208	Phosphors for Lighting Applications	4-0-0-0	4
3	25PHY209	Synthesis and Characterization of Materials	4-0-0-0	4
4	25PHY310	Particle Physics-II	4-0-0-0	4

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Program Structure - Revision of Existing Syllabus & New Courses

S.No	Course Code	Course Title (with LTPS & Credits)	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/ Replaced	Change in outcome	Justification for modification	Revision Percentage
1	25PHY201	Spectroscopic Studies on Transition Metal Ions (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** NIL **UNIT-II:** NIL **UNIT-III:** NIL **UNIT-IV:**Weak crystal field: Ce^{3+} ion, Strong field:Cu^{3+} ion and free radicals. **UNIT-V:**Second order effects: second order effects on radicals in solutions and in oriented radicals, Nuclear quadrupole interactions.	Yes	Based on feedback from faculty	10%
2	25PHY203	Remote Sensing & Geospatial Analysis (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:Introduction to Remote Sensing and Applications** **UNIT-II: NIL** **UNIT-III: Integration of AI/ML in Remote Sensing** – Overview of AI/ML role of AI/ML in image interpretation, object detection, classification, and prediction. **UNIT-IV: NIL** **UNIT-V:** principles of thermal remote sensing; Processing of thermal data	Yes	Based on feedback from faculty	10%
3	25PHY205	Liquid Crystals-I (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Role of bridging and terminal groups in mesophase stability **UNIT-II:** Orientation behaviors: homogeneous, homeotropic, and hybrid alignments **UNIT-III:** Pre-transitional behavior and fluctuation phenomena **UNIT-IV:** Electro hydro dynamic and thermo mechanical instabilities.	Yes	Based on feedback from faculty	10%

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						UNIT-V: Recent advancements in LC texture imaging techniques.			
4	25PHY206	Physics of Solar Engineering (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Advanced Topics and Characterization: Advanced Device Architectures - Characterization Techniques - Modeling and Simulation - Practical Applications and Systems **UNIT-II:** Galerkin Method - Element Formulations - Error Estimation: Céa's Lemma - Linear System Solvers - Nonlinear Equations - Computational Tools. **UNIT-III:** Module and System Design - Energy Storage Integration - Environmental and Economic Impact **UNIT-IV:** Heterojunctions and Interface Passivation - heterojunctions with intrinsic thin-layer (HIT) solar cells - Back-Contact Solar Cells - Interdigitated Back Contact (IBC) solar cells, Multi-Junction Solar Cells - tandem solar cells - Perovskite Solar Cells. **UNIT-V:** Raman Spectroscopy-Lasers and Spectroscopic Techniques - Spectroscopic Characterization - Relativistic and Quantum Electrodynamics (QED) Effects - Computational Spectroscopy.	Yes	Based on feedback from faculty	15%
5	25PHY301	Spectroscopic Studies on Rare Earth Ions (4-0-0-0;	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** NIL **UNIT-II:** NIL **UNIT-III:** NIL **UNIT-IV:** NIL **UNIT-V:** Liquid rare earth lasers, Lasers from vapours of rare earth	Yes	Based on feedback from faculty	

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		Cr: 4)				compounds and Progress in the development of Lasers.			
6	25PHY302	Solid State Ionics (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Defects and Transport in Crystalline Solids **UNIT II: NIL** **UNIT-III:** Nanoelectronics and Nanosensors, Industrial Nanotechnology **UNIT-IV:** Supercapacitors **UNIT –V: NIL**	Yes	Based on feedback from faculty	10%
7	25PHY303	Upper Atmospheric Science (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I: NIL** **UNIT II:** Remote sensing of atmospheric composition from space, Role of atmosphere in global climate feedback. **UNIT III:** Energy transfer by conduction, convection, and radiation in upper layers, Gravity waves and their thermodynamic effects in the upper atmosphere. **UNIT IV:** Impact of greenhouse gases on the thermosphere. **UNIT V:** Stratospheric Chemistry, Ozone chemistry in the stratosphere.	Yes	Based on feedback from faculty	15%
8	25PHY305	Liquid Crystals-II (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Influence of molecular structure on thermal behaviour. **UNIT-II:** Temperature dependence of optical transitions. **UNIT-III:** Lifespan and degradation mechanisms in display devices. **UNIT-IV:** Emerging applications: sensors, tunable photonic devices.	Yes	Based on feedback from faculty	10%

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						UNIT-V: Chirality, frustration, and defect structures in TGB phases.			
9	25PHY306	Advanced Solar Energy Storage Technologies (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Hydrogen as an Energy Carrier - Hybrid Energy Systems - Grid Integration and Smart Grids - Modeling and Simulation - Economic and Policy Aspects. **UNIT-II:** Solar Thermal Energy Storage - sensible heat storage, latent heat storage - thermochemical storage- Industrial Process Heat (SHIP) - Solar Cooling and Desalination - absorption refrigeration cycles - Solar Passive Architecture - Modeling and Simulation - CFD. **UNIT-III:** Thermal Energy Storage (TES) -Thermochemical storage - System Integration and Control - Building Simulation and Modeling - TRNSYS, EnergyPlus, MATLAB - Economics and Environmental Impact. **UNIT-IV:** - Hybrid Systems - solar thermal with conventional heat sources - Techno-Economic Analysis - Modeling and Simulation -Materials Research - AI-Powered Performance Prediction for Machine Vision. **UNIT-V:** Natural Ventilation for Hydrogen Facilities - solar chimneys - Building Energy Simulation - techno-economic analysis - Computational Fluid Dynamics (CFD) - Life-Cycle Assessment (LCA) - Experimental Design on solar thermal applications.	Yes	Based on feedback from faculty	20%

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10	25PHY307	Aeronomy (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT – I :** Influence of space weather events on the thermosphere. **UNIT – II:** Ion-neutral chemistry in the mesosphere and thermosphere. **UNIT – III:** Data assimilation techniques using GNSS and satellite measurements. **UNIT – IV:** AI-based prediction of ionospheric disturbances. **UNIT – V: Ionospheric Morphology & Disturbances** Ionospheric scintillation and its impact on communication/navigation systems, Space weather forecasting and ionospheric response, Role of geomagnetic storms and substorms in ionospheric morphology.	Yes	Based on feedback from faculty	10%
11	25PHY308	Thin Film Technology and Applications (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	**UNIT-I:** Different synthesis methods of thin films**(Added)** **UNIT-II:** Thermodynamics and Kinetics of thin film formation, Microbalance technique. **(Removed)** **UNIT-III:** Differential scanning spectrometry (DSC), Fourier transform spectroscopy (FTIR), Conductivity testing, Discharge characterization, LSV, CVV. **UNIT-IV:** Experimental methods for mechanical properties of thin films. **UNIT-V:** corrosion and wear coatings, active electronic elements, micro acoustic elements using surface waves - integrated circuits**(Removed)**	Yes	Based on feedback from faculty	10%

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12	25PHY202	Nano Science and Technology (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	No change	Yes	Based on feedback from faculty	-
13	25PHY204	Nuclear Physics-I (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	No change	Yes	Based on feedback from faculty	-
14	25PHY304	Nuclear Physics-II (4-0-0-0; Cr: 4)	Professional Core	Annexure-I	Annexure-I	No change	Yes	Based on feedback from faculty	-
15	25PHY207	Particle Physics-I (4-0-0-0; Cr:4)	Professional Core	Annexure-II	Annexure-II	New Syllabus	Yes	Based on feedback from faculty	-
16	25PHY207	Phosphors for Lighting Applications (4-0-0-0; Cr: 4)	Professional Core	Annexure-II	Annexure-II	New Syllabus	Yes	Based on feedback from faculty	-
17	25PHY310	Particle Physics-II (4-0-0-0; Cr: 4)	Professional Core	Annexure-II	Annexure-II	New Syllabus	Yes	Based on feedback from faculty	-
18	25PHY209	Synthesis and Characterization of Materials (4-0-0-0; Cr: 4)	Professional Core	Annexure-II	Annexure-II	New Syllabus	Yes	Based on feedback from faculty	-

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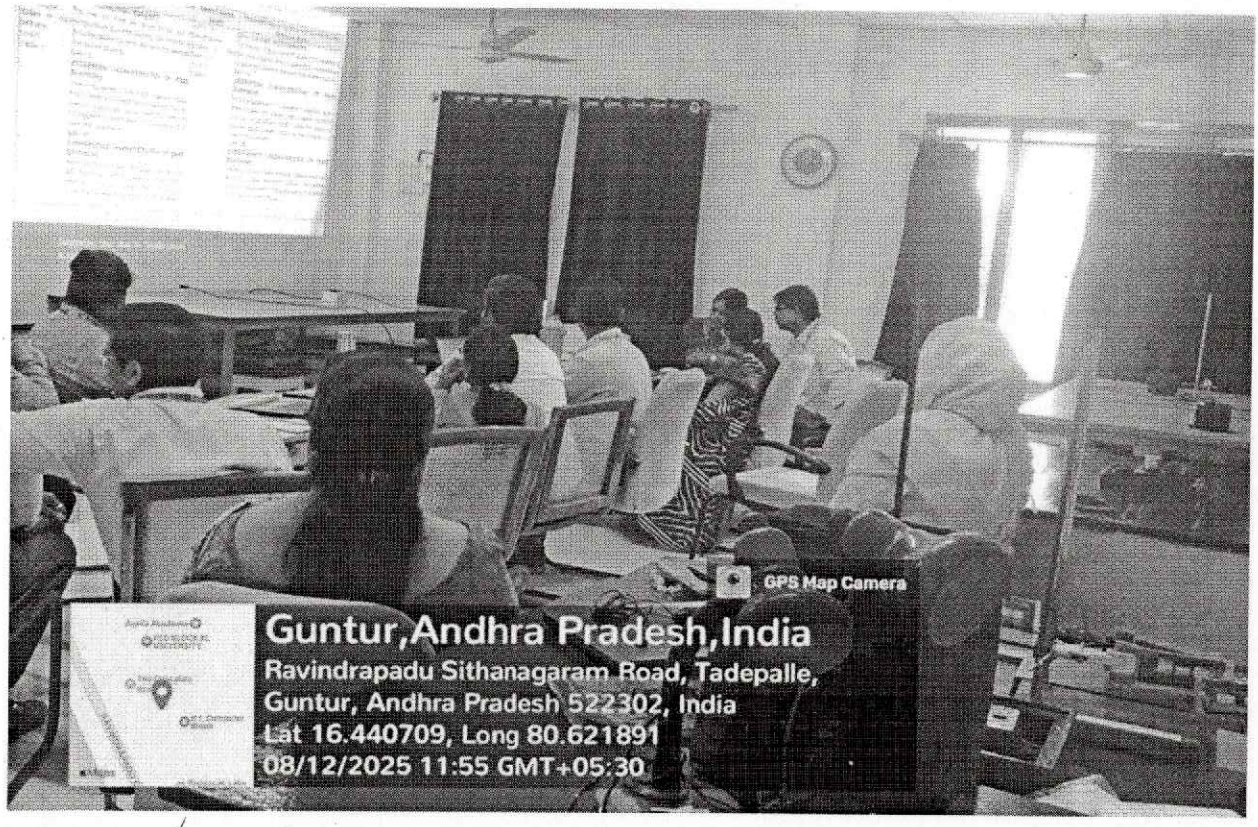

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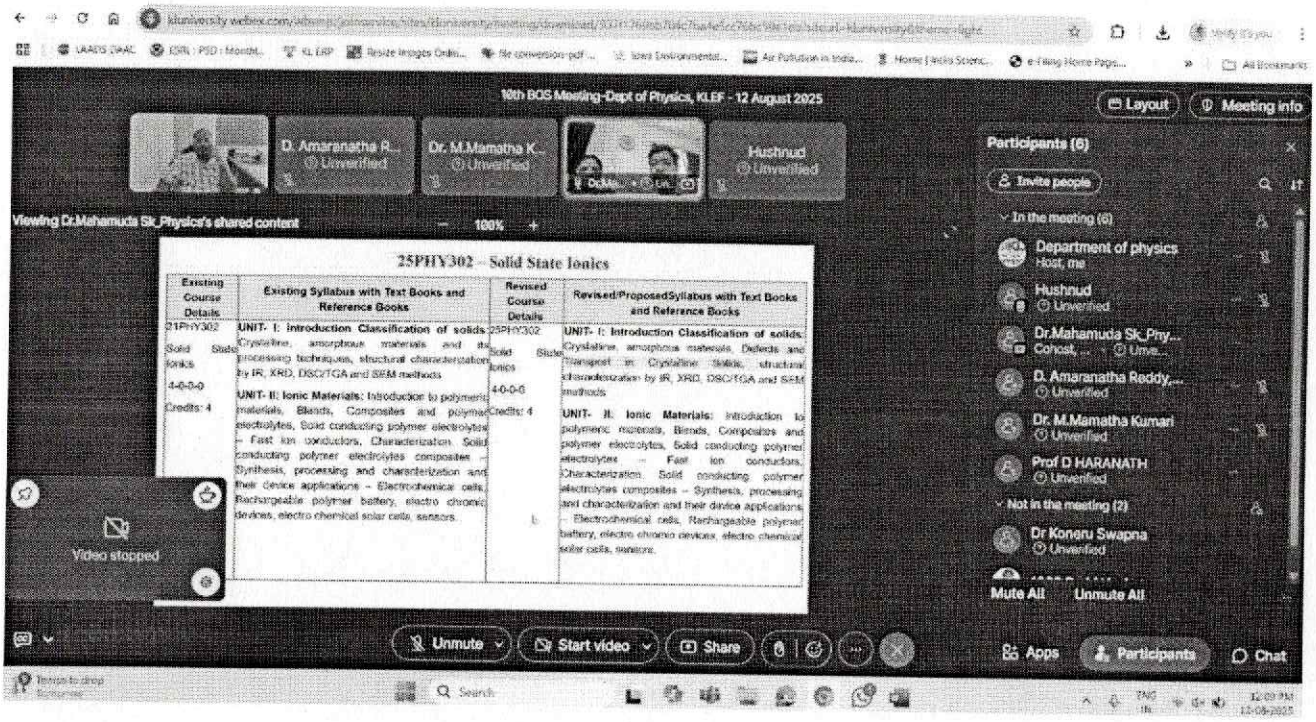

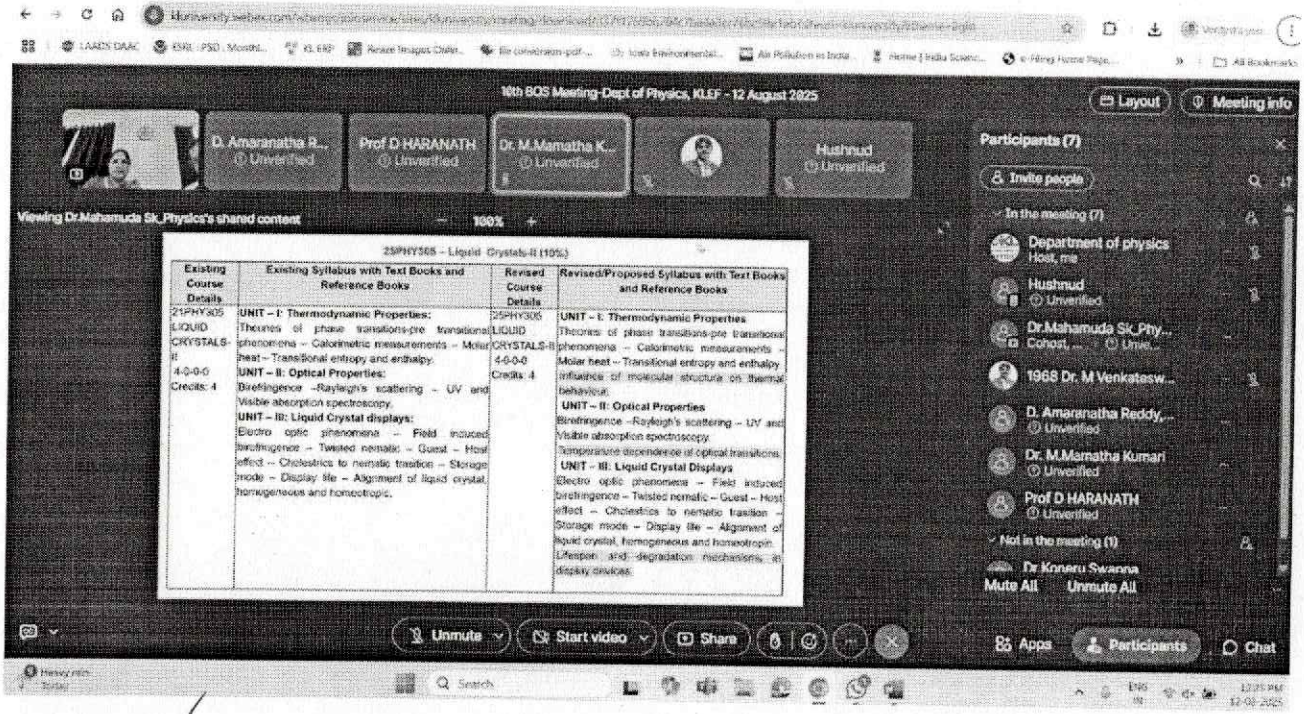

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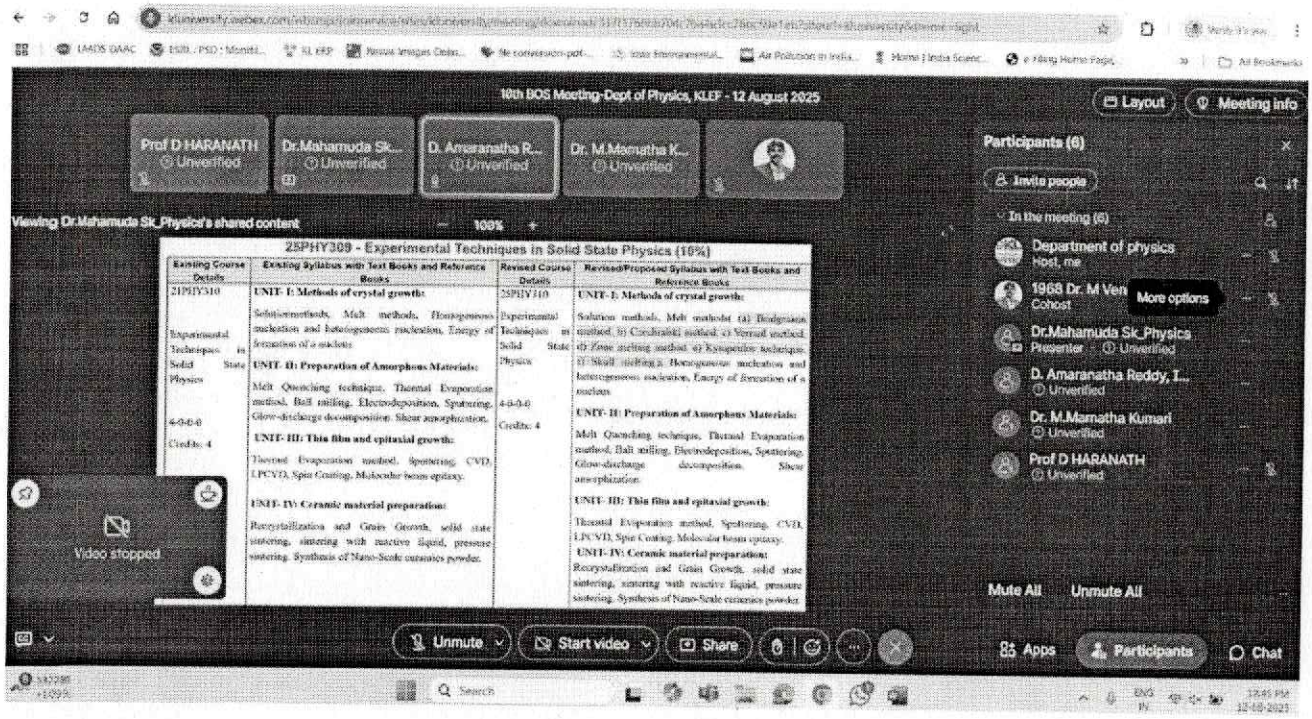

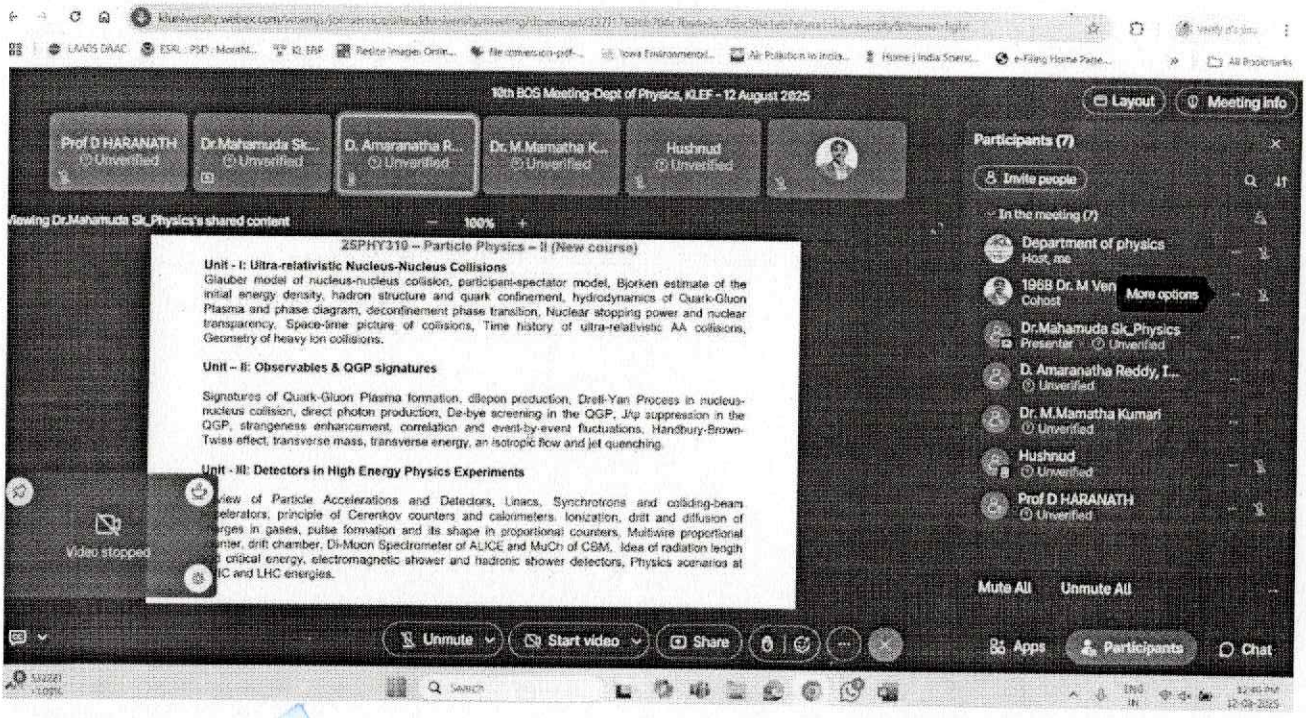

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List of Pre-PhD Courses for the AY 2025-26
DEPARTMENT OF PHYSICS

S.NO	PAPER–2	Course Code (LTPS)	PAPER – 3	Course Code (LTPS)
1.	Spectroscopic Studies on Transition Metal Ions	25PHY201 (4-0-0-0)	Spectroscopic Studies on Rare Earth Ions	25PHY301 (4-0-0-0)
2.	Nanoscience and Technology	25PHY202 (4-0-0-0)	Solid State Ionics	25PHY302 (4-0-0-0)
3.	Remote Sensing & Geospatial Analysis	25PHY203 (4-0-0-0)	Upper Atmospheric Science	25PHY303 (4-0-0-0)
4.	Nuclear Physics-I	25PHY204 (4-0-0-0)	Nuclear Physics - II	25PHY304 (4-0-0-0)
5.	Liquid Crystals-I	25PHY205 (4-0-0-0)	Liquid Crystals-II	25PHY305 (4-0-0-0)
6.	Physics of Solar Engineering	25PHY206 (4-0-0-0)	Advanced Solar Energy Storage Technologies	25PHY306 (4-0-0-0)
7.	Particle Physics-I	25PHY207 (4-0-0-0)	Aeronomy	25PHY307 (4-0-0-0)
8.	Phosphors for Lighting Applications	25PHY208 (4-0-0-0)	Thin Film Technology and Applications	25PHY308 (4-0-0-0)
9.	Synthesis and Characterization of Materials	25PHY209 (4-0-0-0)	Particle Physics-II	25PHY309 (4-0-0-0)

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ANNEXURE – I: REVISION OF EXISTING COURSES IN THE PRE-PHD CURRICULUM FOR THE AY 2025-26

25PHY201 – Spectroscopic Studies on Transition Metal Ions

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY201 **Spectroscopic Studies on Transition metal ions** 4-0-0-0 Credits: 4	**UNIT- I: INTRODUCTION:** The concept of ligand field - The scope of ligand field theory – The'd' and other orbital's. The physical properties affected by ligand fields. **UNIT- II: QUANTITAVIVE BASIS OF CRYSTALFIELDS:** Crystal field theory – The octahedral crystal field potential on the'd' wave function – The evaluation of 10 Dq – The tetrahedral potential. **UNIT- III: FREE ION IN WEAK, MEDIUM, AND STRONG CRYSTALFIELDS:** The effect of a cubic crystal field on S and P terms – on D terms – on F terms – on G, H and I terms – Strong field configurations – Transition from weak to strong crystal fields – term energy level diagrams – Tanabe-	25PHY201 **Spectroscopic Studies on Transition metal ions** 4-0-0-0 Credits: 4	**UNIT- I: INTRODUCTION:** The concept of ligand field - The scope of ligand field theory – The'd' and other orbital's. The physical properties affected by ligand fields. **UNIT- II: QUANTITAVIVE BASIS OF CRYSTALFIELDS:** Crystal field theory – The octahedral crystal field potential on the 'd' wave function – The evaluation of 10 Dq – The tetrahedral potential. **UNIT- III: FREE ION IN WEAK, MEDIUM, AND STRONG CRYSTALFIELDS:** The effect of a cubic crystal field on S and P terms – on D terms – on F terms – on G, H and I terms – Strong field configurations – Transition from weak to strong crystal fields – term energy level diagrams – Tanabe-	**UNIT-I:** NIL **UNIT-II:** NIL **UNIT-III:** NIL **UNIT-IV:** Weak crystal field: Ce^{3+} ion, Strong field:Cu^{3+} ion and free radicals. **UNIT-V:** Second order effects: second order effects on radicals in solutions and in oriented radicals, Nuclear quadrupole interactions.	10%	Based on the feedback received from Faculty and scholars

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	Sugano diagrams. **UNIT- IV: BASIC THEORY g-FACTOR:** The g-factor – the general Hamiltonian – The crystal field and orbital symmetry – Symmetry of p and d orbitals – Effect of crystal field – Jahn-Teller distortion and Kramer's theorem – Magnitude of the crystal field – Calculation of g-factors – Ti3+ in octahedral field. The spin-Hamiltonian – effect of field orientation – Fine structure – Zero-field splitting, The Spin-Hamiltonian for V^{3+} and S-stateions-Mn^{2+} ion. **UNIT-V:NUCLEAR HYPERFINE STRUCTURE:** Introduction – General treatment – Isotropic hyperfine interaction – The spin-Hamiltonian energy levels – Interpretation of isotropic hyperfine coupling constant – Unpaired spin density – Anisotropic hyperfine interaction – The Spin-Hamiltonian energy levels – Interpretation of anisotropic hyperfine coupling constants – the term <(1 – 3 Cos2 / r3)>av		Sugano diagrams. **UNIT- IV: BASIC THEORY of g-FACTOR:** The g-factor – the general Hamiltonian – The crystal field and orbital symmetry – Symmetry of p and d orbitals – Effect of crystal field – Jahn-Teller distortion and Kramer's theorem – Magnitude of the crystal field – Calculation of g-factors – Ti^{3+} in octahedral field, Weak crystal field: Ce^{3+} ion, Strong field:Cu^{3+} ion and free radicals. The spin-Hamiltonian – effect of field orientation – Fine structure – Zero-field splitting, The Spin-Hamiltonian for V^{3+} and S-state ions-Mn^{2+} ion. **UNIT-V:NUCLEAR HYPERFINE STRUCTURE:** Introduction – General treatment – Isotropic hyperfine interaction – The spin-Hamiltonian energy levels – Interpretation of isotropic hyperfine coupling constant – Unpaired spin density – Anisotropic hyperfine interaction – The Spin-Hamiltonian energy levels – Interpretation of anisotropic hyperfine coupling constants – the term <(1 – 3 Cos2 / r3)>av, Second order effects: second order effects on radicals in solutions and in oriented radicals, Nuclear quadrupole interactions.			

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	TEXT BOOKS: 1. Introduction to Ligand Fields. B.N.Figgis, Wiley – Eastern Ltd., New Delhi (1976). 2. Electron Spin Resonance in Chemistry. Peter B.Ayscough. Methuen and Co.Ltd., London (1964). 3. Instrumental Methods and Analysis. H.Willard, L.Merritt, J.Dean,F.Settle, CBS publishers and distributors (1986). 4. Fundamentals of Molecular Spectroscopy. C.N.Banwell, Tata-McGraw-Hill publishing company Ltd, New Delhi (1990).		**TEXT BOOKS:** 1. Introduction to Ligand Fields. B.N.Figgis, Wiley – Eastern Ltd., New Delhi (1976). 2. Electron Spin Resonance in Chemistry. Peter B.Ayscough. Methuen and Co.Ltd., London (1964). 3. Instrumental Methods and Analysis. H.Willard, L.Merritt, J.Dean,F.Settle, CBS publishers and distributors (1986). 4. Fundamentals of Molecular Spectroscopy. C.N.Banwell, Tata-McGraw-Hill publishing company Ltd, New Delhi (1990).			

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25PHY301 – Spectroscopic Studies on Rare Earth Ions

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY 301 **Spectroscopic Studies on Rare Earth ions** 4-0-0-0 Credits: 4	**Unit – I:** **ATOMICSPECTROSCOPY:** The free ion: Free ion terms for d2 and f2 configurations; Spin-orbit coupling; Ground states for fn configurations; Coulomb and spin-orbit energies; Intermediate coupling. **Unit – II:** **ABSORPTION CHARACTERISTICS OF RARE EARTHIONS:** Intra-configurational f-f transitions; magnetic dipole, electric dipole and induced electric dipole transitions; Intensity of absorption bands; Judd-Ofelt theory for induced electric dipole transitions and evaluation of Judd-Ofelt parameters. **Unit – III:** **LUMINESCENCE CHARACTERISTICS OF RARE EARTHIONS:** Radiative transition rates, Emission cross-sections and Branching ratios, relaxiation process: Non-radiative relaxiation: Multi-phonon, Radiative quantum efficiencies of rare earth ion energy levels.	25PHY301 **Spectroscopic Studies on Rare Earth ions** 4-0-0-0 Credits: 4	**Unit – I:** **ATOMICSPECTROSCOPY:** The free ion: Free ion terms for d2 and f2 configurations; Spin-orbit coupling; Ground states for fn configurations; Coulomb and spin-orbit energies; Intermediate coupling. **Unit – II:** **ABSORPTION CHARACTERISTICS OF RARE EARTHIONS:** Intra-configurational f-f transitions; magnetic dipole, electric dipole and induced electric dipole transitions; Intensity of absorption bands; Judd-Ofelt theory for induced electric dipole transitions and evaluation of Judd-Ofelt parameters. **Unit – III:** **LUMINESCENCE CHARACTERISTICS OF RARE EARTHIONS:** Radiative transition rates, Emission cross-sections and Branching ratios, relaxation process: Non-radiative relaxation: Multi-phonon, Radiative quantum efficiencies of rare earth ion energy levels.	**UNIT-I:** NIL **UNIT-II:** NIL **UNIT-III:** NIL **UNIT-IV:** NIL **UNIT-V:** Liquid rare earth lasers, Lasers from vapours of rare earth compounds and Progress in the development of Lasers.	10%	Based on the feedback received from Faculty and scholars

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	Unit – IV: **ENERGY TRANSFER IN RAREEARTHS:** Possible mechanisms of energy transfer: Resonance energy transfer; Process of IR to Visible upconversion; Energy transfer from lanthanides to other species. **Unit – V:** **RARE EARTH DOPEDLASERS:** Principle of laser action: typical rare earth lasers- Nd: YAG: Energy level diagram of Nd(III) ion in YAG laser. **Textbooks:** 1. Introduction to Ligand Fields. B N Figgis, Wiely Eastern Ltd, New Delhi. John Wiley & Sons Inc,1966 **Reference Books:** 1. Optical Spectra of Transparent Rare Earth Compounds. S Hufner, Academic Press, London, 1978. 2. Lasers and excited states of Rare Earths. R Reisfield and C K Jorgensen, Springer-Verlag, New York,1977.		**Unit – IV:** **ENERGY TRANSFER IN RAREEARTHS:** Possible mechanisms of energy transfer: Resonance energy transfer; Process of IR to Visible up-conversion; Energy transfer from lanthanides to other species. **Unit – V:** **RARE EARTH DOPEDLASERS:** Principle of laser action: typical rare earth lasers- Nd: YAG: Energy level diagram of Nd(III) ion in YAG laser, Liquid rare earth lasers, Lasers from vapours of rare earth compounds and Progress in the development of Lasers. **Textbooks:** 1. Introduction to Ligand Fields. B N Figgis, Wiely Eastern Ltd, New Delhi. John Wiley & Sons Inc,1966 **Reference Books:** 1. Optical Spectra of Transparent Rare Earth Compounds. S Hufner, Academic Press, London, 1978. 2. Lasers and excited states of Rare Earths. R Reisfield and C K Jorgensen, Springer-Verlag, New York,1977.			

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25PHY202 – Nanoscience and Technology

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY202 Nanoscience and Technology 4-0-0-0 Credits: 4	**Unit - I:** Introduction: Importance of Nano science &technology, Emergence of Nano-technology, Types of Nano materials, Bottom-up and Top-down approaches,, Applications of Nano Technology in Science and technology. **Unit - II:** Zero Dimensional Nano-structures: Nano particles through homogenous nucleation; Growth of nuclei, synthesis of metallic nano particles, Nano particles through heterogeneous nucleation; Fundamentals of heterogeneous nucleation and synthesis ofnano particles using micro emulsions and Aerosol. **Unit – III:** One Dimensional Nano-structure, Nano wires and nano rods: Spontaneous growth: Evaporation and condensation growth, Casting method, vapor-liquid-solid growth, Electrochemical deposition and Electro spinning.	25PHY202 Nanoscience and Technology 4-0-0-0 Credits: 4	**Unit - I:** Introduction: Importance of Nano science &technology, Emergence of Nano-technology, Types of Nano materials, Bottom-up and Top-down approaches,, Applications of Nano Technology in Science and technology. **Unit - II:** Zero Dimensional Nano-structures: Nano particles through homogenous nucleation; Growth of nuclei, synthesis of metallic nano particles, Nano particles through heterogeneous nucleation; Fundamentals of heterogeneous nucleation and synthesis ofnano particles using micro emulsions and Aerosol. **Unit – III:** One Dimensional Nano-structure, Nano wires and nano rods: Spontaneous growth: Evaporation and condensation growth, Casting method, vapor-liquid-solid growth, Electrochemical deposition and Electro spinning.	**UNIT-I:** NIL **UNIT-II:** NIL **UNIT-III:** NIL **UNIT-IV:** NIL **UNIT-V:**NIL	No change in syllabus	Based on the feedback received from Faculty and scholars

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	Unit – IV: Two dimensional nano-structures: Fundamentals of film growth. Physical vapourDepostion(PVD): Chemical VapourDepostion (CVD) Characterization of nano materials by using spectroscopic and microscopic techniques-XRD,FTIR,DSC,SEM and TEM. Electrical measurements of nano composite materials by using fourprobemethod. **Unit – V:** Introduction to Carbon Nano Tubes(CNTs), Properties, Preparation of CNTs-Laser ablation method, Arc method, chemical vapor deposition (CVD), Sol-Gel method, Carbon nanotube Polymer Nano composites ,Applications of Nano in drug delivery system. **Text books:** 1. Introduction to Nano technologyby Charles P.Poole.Jr.& Frank J.ownesJohnwielly&sons Inc. Publishers-2006 2. Nano structures and Nano materials: Synthesis, properties and applicationsGuozhong Cao- Imperial Collegepress.		**Unit – IV:** Two dimensional nano-structures: Fundamentals of film growth. Physical vapourDepostion(PVD): Chemical VapourDepostion (CVD) Characterization of nano materials by using spectroscopic and microscopic techniques-XRD,FTIR,DSC,SEM and TEM. Electrical measurements of nano composite materials by using fourprobemethod. **Unit – V:** Introduction to Carbon Nano Tubes(CNTs), Properties, Preparation of CNTs-Laser ablation method, Arc method, chemical vapor deposition (CVD), Sol-Gel method, Carbon nanotube Polymer Nano composites ,Applications of Nano in drug delivery system. **Text books:** 3. Introduction to Nano technologyby Charles P.Poole.Jr.& Frank J.ownesJohnwielly&sons Inc. Publishers-2006 4. Nano structures and Nano materials: Synthesis, properties and applicationsGuozhong Cao- Imperial Collegepress.			

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25PHY302 – Solid State Ionics

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/ProposedSyllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY302 Solid State Ionics 4-0-0-0 Credits: 4	**UNIT- I: Introduction Classification of solids:** Crystalline, amorphous materials and its processing techniques, structural characterization by IR, XRD, DSC/TGA and SEM methods **UNIT- II: Ionic Materials:** Introduction to polymeric materials, Blends, Composites and polymer electrolytes, Solid conducting polymer electrolytes – Fast ion conductors, Characterization. Solid conducting polymer electrolytes composites – Synthesis, processing and characterization and their device applications – Electrochemical cells, Rechargeable polymer battery, electro chromic devices, electro chemical solar cells, sensors. **UNIT- III: Nano materials:** Introduction to nano particles and nano composites, synthesis and processing technologies for nanostructure materials – Chemical co-precipitation method, soldzer method, hydrothermal method, copolymerization method – Chemical oxidative polymerization method, structural, mechanical, optical and electrical studies of nano composites conductivity and electrical transport properties of processable nano materials –	25PHY302 Solid State Ionics 4-0-0-0 Credits: 4	**UNIT- I: Introduction Classification of solids:** Crystalline, amorphous materials,Defects and Transport in Crystalline Solids,structural characterization by IR, XRD, DSC/TGA and SEM methods **UNIT- II: Ionic Materials:** Introduction to polymeric materials, Blends, Composites and polymer electrolytes, Solid conducting polymer electrolytes – Fast ion conductors, Characterization. Solid conducting polymer electrolytes composites – Synthesis, processing and characterization and their device applications – Electrochemical cells, Rechargeable polymer battery, electro chromic devices, electro chemical solar cells, sensors. **UNIT- III: Nano materials:** Introduction to nano particles and nano composites, synthesis and processing technologies for nanostructure materials – Chemical co-precipitation method, sol-gel method, hydrothermal method, Mechanical, optical and electrical studies of nano composites conductivity and electrical transport properties of processable nanomaterials– Nanoelectronics and Nanosensors, Industrial Nanotechnology, Applications.	**UNIT-I:** Defects and Transport in Crystalline Solids **UNIT II: NIL** **UNIT-III:** Nanoelectronics and Nanosensors, Industrial Nanotechnology **UNIT-IV:** Supercapacitors **UNIT –V: NIL**	10%	Based on the feedback received from Faculty and scholars

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	Applications. **UNIT- IV: Electrochemical cell Devices:** Introduction to Electro chemical cells, sensors and fuel cells – Types– Synthesis and development of solid electrolyte membranes – Characterization by XRD, Differential scanning calorimetry (DSC), SEM (Scanning Electron Microscopy) **UNIT- V: Measurements:** Measurement of electrical conductivity of solid electrolyte membranes – Determination of transference number by Wagner's polarization method, water balance in membranes Fabrication and working principles of Electro chemical cell, fuel cell, sensors– Calculation of open circuit voltage (OCV), short circuit current, resistivity, current density, power density and estimation of efficiency, V-I characteristics of fuel cells, Application of fuel cells in transportation and low temperature electronic devices . **Textbooks:** 1.Solid state Ionics for Batteries by M. Tatsumisago,M. Wakihara etc., Springer Publishers 2.Solid state Ionics by B.V.R. Chowdary,Wenji.B.World Scientifics Ltd. **Reference Books:** 1.Defects and Transport in Crystalline Solids, Kofstad P., Norby T., 1st edition, 2007.		**UNIT- IV: Electrochemical cell Devices:** Introduction to Electro chemical cells, sensors and fuel cells – Types– Synthesis and development of solid electrolyte membranes, Supercapacitors – Characterization by XRD, Differential scanning calorimetry (DSC), SEM (Scanning Electron Microscopy) **UNIT- V: Measurements:** Measurement of electrical conductivity of solid electrolyte membranes – Determination of transference number by Wagner's polarization method, water balance in membranes Fabrication and working principles of Electro chemical cell, fuel cell, sensors– Calculation of open circuit voltage (OCV), short circuit current, resistivity, current density, power density and estimation of efficiency, V-I characteristics of fuel cells, Application of fuel cells in transportation and low temperature electronic devices . **Textbooks:** 1.Solid state Ionics for Batteries by M. Tatsumisago,M. Wakihara etc., Springer Publisher, 2005. 2.Solid state Ionics by B.V.R. Chowdary,Wenji.B.World Scientifics Ltd. **Reference Books:** 1.Defects and Transport in Crystalline Solids, Kofstad P., Norby T., 1st edition, 2007.			

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25PHY203 – Remote Sensing & Geospatial Analysis

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY203 Remote Sensing Techniques 4-0-0-0 Credits: 4	**CHAPTER 1: Introduction** Definition - SONAR, Satellite Images Vs Maps, Remote Sensing Vs GIS, Remote Sensing Vs Aerial Photography / Photogrammetry, Remote Sensing Vs SONAR, Spatial data acquisition ground based and remote sensing methods, application of remote sensing-Agriculture, Forestry, Geology, Hydrology, Sea Ice, Land Cover & Land Use, Mapping, Oceans & Coastal Monitoring. **CHAPTER 2: Electromagnetic Radiation** Electromagnetic energy, Interaction mechanisms, Laws regarding the amount of energy radiated from an object, Planck Radiation Law, Wien's displacement law, Black body concept, Emissivity and Radiant Temperature, Electromagnetic Spectrum, Wavelength bands, Atmosphere effects, Scattering, Absorption, Reflectance spectra, Mixtures, Grain Size Effects, The Continuum and Band Depth, Continuum-Removed Spectral Feature Comparison, Viewing Geometry.	25PHY203 Remote Sensing & Geospatial Analysis 4-0-0-0 Credits: 4	**UNIT-I: Introduction To Remote Sensing And Applications** Definition – SONAR; Satellite Images Vs Maps; Remote Sensing Vs GIS; Remote Sensing Vs Aerial Photography / Photogrammetry; Remote Sensing Vs SONAR; Spatial data acquisition ground based and remote sensing methods; Applications of remote sensing-Agriculture, Forestry, Geology, Hydrology, Sea Ice, Land Cover & Land Use, Mapping, Oceans & Coastal Monitoring. **UNIT-II: Electromagnetic Radiation** Electromagnetic spectrum and energy; Interaction mechanisms; Laws regarding the amount of energy radiated from an object; Planck Radiation Law; Wien's displacement law; Black body concept; Emissivity and Radiant Temperature; Wavelength bands; Atmosphere effects; Scattering and Absorption; Reflectance spectra; Mixtures and Grain Size Effects; Continuum and Band Depth; Continuum-Removed Spectral Feature Comparison; Viewing Geometry.	**UNIT-I:Introduction to Remote Sensing and Applications** **UNIT-II: NIL**	10%	Based on the feedback received from Faculty and scholars

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	CHAPTER 3: SENSORS and PLATFORMS Introduction, Sensors – passive sensors, active sensors – radar, principles of imaging radar, geometric properties of radar, data formats, distortions in radar images, interpretation of radar images, applications of radar, Airborne remote sensing, Space borne remote sensing, Image data characteristics, Data selection criteria.		**UNIT-III: Sensors And Platforms** Introduction to sensors; Sensor types – passive sensors, active sensors; Radar characteristics; principles of imaging radar; geometric properties of radar; data formats; distortions in radar images; interpretation of radar images; applications of radar; Airborne remote sensing; Space borne remote sensing; Image data characteristics; Data selection criteria. Integration of AI/ML in Remote Sensing – Overview of AI/ML role of AI/ML in image interpretation, object detection, classification, and prediction.	**UNIT-III:** Integration of AI/ML in Remote Sensing – Overview of AI/ML role of AI/ML in image interpretation, object detection, classification, and prediction.		
	CHAPTER 4: RADIO METRIC CORRECTIONS Introduction, From satellite to ground radiances: atmospheric correction, Atmospheric correction in the visible part of the spectrum – cosmetic corrections, relative AC methods based on ground reflectance, Absolute AC methods based on atmospheric processes.		**UNIT-IV: RADIO METRIC CORRECTIONS** Introduction, From satellite to ground radiances: atmospheric correction, Atmospheric correction in the visible part of the spectrum – cosmetic corrections, relative AC methods based on ground reflectance, Absolute AC methods based on atmospheric processes.	**UNIT-IV: NIL**		
	CHAPTER 5: THERMAL REMOTE SENSING Introduction, remote sensing laws-physical laws, blackbodies and emissivity, Radiant and kinetic temperatures,– band ratios and transformations, determining kinetic surface temperatures, Thermal applications – rock emissivity mapping, thermal hot spot detection.		**UNIT-V: THERMAL REMOTE SENSING** Introduction, principles of thermal remote sensing- physical laws, blackbodies and emissivity, Radiant and kinetic temperatures, Processing of thermal data – band ratios and transformations, determining kinetic surface temperatures, Thermal applications – rock emissivity mapping, thermal hot spot detection.	**UNIT-V:** principles of thermal remote sensing; Processing of thermal data		

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	Text Books 1. Campbell, J.B., and Wynne, R.H. Introduction to Remote Sensing (5th Edition). Guilford Press, 2011. ISBN: 978-1609181765. 2. Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. Remote Sensing and Image Interpretation(7th Edition). Wiley, 2015. ISBN: 978-1118343289. 3. Gonzalez, R.C., and Woods, R.E. Digital Image Processing (4th Edition). Pearson, 2018. ISBN: 978-0133356724.		**Text Books** 1. Campbell, J.B., and Wynne, R.H. Introduction to Remote Sensing (5th Edition). Guilford Press, 2011. ISBN: 978-1609181765. 2. Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. Remote Sensing and Image Interpretation(7th Edition). Wiley, 2015. ISBN: 978-1118343289. 3. Gonzalez, R.C., and Woods, R.E. Digital Image Processing (4th Edition). Pearson, 2018. ISBN: 978-0133356724. **Reference Books** 1.Nichol, J., and Wong, M.S. Thermal Remote Sensing of Urban and Natural Environments. CRC Press, 2017. ISBN: 978-1138892841. 2. Richards, J.A., and Jia, X. Remote Sensing Digital Image Analysis (5th Edition). Springer, 2020. ISBN: 978-3662603223.			

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25PHY303 – Upper Atmospheric Science

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY303 Upper Atmospheric Science 4-0-0-0 Credits: 4	**CHAPTER 1: Introduction** Survey of atmosphere, Physical properties of the upper atmosphere – atmospheric composition, atmospheric dynamics, atmospheric energetic, atmospheric layers and relation to temperature. **CHAPTER 2: Earth System** Interaction of energetic solar photons with the upper atmosphere, History of Climate and the Earth System, Components of the Earth System, Hydrologic & carbon cycles, Solar irradiance, optical depth, Photo-ionization, photo dissociation, photoelectrons. **CHAPTER 3: Atmospheric Thermodynamics** Gas Laws, Hydrostatic Equation, First Law of Thermodynamics, Adiabatic Processes, Water Vapor in Air, Static Stability, Second Law of Thermodynamics and Entropy.	25PHY303 Upper Atmospheric Science 4-0-0-0 Credits: 4	**UNIT I: Introduction** Survey of atmosphere, Physical properties of the upper atmosphere – atmospheric composition, atmospheric dynamics, atmospheric energetic, atmospheric layers and relation to temperature. **UNIT II: Earth System** Interaction of energetic solar photons with the upper atmosphere, History of Climate and the Earth System, Components of the Earth System, Hydrologic & carbon cycles, Solar irradiance, optical depth, Photo-ionization, photo dissociation, photoelectrons, Remote sensing of atmospheric composition from space, Role of atmosphere in global climate feedback. **UNIT III: Atmospheric Thermodynamics** Gas Laws, Hydrostatic Equation, First Law of Thermodynamics, Adiabatic Processes, Water Vapor in Air, Static Stability, Second Law of Thermodynamics and Entropy, Energy transfer by conduction, convection, and radiation in upper layers, Gravity waves and their thermodynamic effects in the upper atmosphere.	**UNIT-I: NIL** **UNIT II:** Remote sensing of atmospheric composition from space, Role of atmosphere in global climate feedback. **UNIT III:** Energy transfer by conduction, convection, and radiation in upper layers, Gravity waves and their thermodynamic effects in the upper atmosphere.	15%	Based on the feedback received from Faculty and scholars

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	CHAPTER 4: Radiative Transfer Spectrum of Radiation, Quantitative Description of Radiation, Blackbody Radiation, Physics of Scattering and Absorption and Emission, Radiative Transfer in Planetary Atmospheres, Radiation Balance at the Top of the Atmosphere. **CHAPTER 5: Atmospheric Chemistry** Composition of Troposphere Air, Sources, Transport, and Sinks of Trace Gases, Some Important Troposphere Trace Gases, Troposphere Aerosols, Air Pollution, Troposphere Chemical Cycles, Stratospheric Chemistry. **Text Books** 1. Physics and chemistry of the Upper atmosphere ByM.H.Rees. 2. Atmospheric Science By John M.Wallace, Peter V. Hobbs.		**UNIT IV: Radiative Transfer** Spectrum of Radiation, Quantitative Description of Radiation, Blackbody Radiation, Physics of Scattering and Absorption and Emission, Radiative Transfer in Planetary Atmospheres, Radiation Balance at the Top of the Atmosphere, Impact of greenhouse gases on the thermosphere. **UNIT V: Atmospheric Chemistry** Composition of Troposphere Air, Sources, Transport, and Sinks of Trace Gases, Some Important Troposphere Trace Gases, Troposphere Aerosols, Air Pollution, Troposphere Chemical Cycles, Stratospheric Chemistry. Ozone chemistry in the stratosphere. **Text Books** 1. Wallace, J.M., and Hobbs, P.V. Atmospheric Science: An Introductory Survey (2nd Edition). Academic Press, 2006. ISBN: 978-0127329512. 2. Andrews, D.G. An Introduction to Atmospheric Physics (2nd Edition). Cambridge University Press, 2010. ISBN: 978-0521693189. 3. Houghton, J.T. The Physics of Atmospheres (3rd Edition). Cambridge University Press, 2002. ISBN: 978-0521011228.	**UNIT IV:** Impact of greenhouse gases on the thermosphere. **UNIT V:** Stratospheric Chemistry, Ozone chemistry in the stratosphere.		

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			Reference Book 1. Lary, D.J. Artificial Intelligence and Climate Science. Springer, 2021. ISBN: 978-3030658756. 2. Physics and chemistry of the Upper atmosphere ByM.H.Rees, CRC Press, 2003.sss			

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25PHY204 – Nuclear Physics-I

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY204 Nuclear Physics-I 4-0-0-0	**UNIT – I:** Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi- empirical mass formula; Liquid drop model; Fission and fusion. **UNIT – II:** Two nucleon problem, Elementary ideas of alpha, beta and gamma decays and their selection rules; Nuclear Forces: Characteristics of nuclear forces – Ground state of Deuteron – Proton – Proton scattering – Neutron – Proton scattering – Meson theory of nuclear forces. **UNIT – III:** Nuclear Models: Introduction – The liquid drop model – Bethe-Weizacker semi-empirical binding energy equation and its applications – Nuclear shell model – Shell Model: Single particle model with square well, harmonic oscillator and spin-orbit potentials, Collective model, Nilsson model. Energy levels and calculation of angular momentum – Collective model. **UNIT –IV:** Nuclear Reactions: Types of nuclear reactions – Compound nuclear reactions – Nuclear cross section – Resonance	25PHY204 Nuclear Physics-I 4-0-0-0	**UNIT – I:** Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi- empirical mass formula; Liquid drop model; Fission and fusion. **UNIT – II:** Two nucleon problem, Elementary ideas of alpha, beta and gamma decays and their selection rules; Nuclear Forces: Characteristics of nuclear forces – Ground state of Deuteron – Proton – Proton scattering – Neutron – Proton scattering – Meson theory of nuclear forces. **UNIT – III:** Nuclear Models: Introduction – The liquid drop model – Bethe-Weizacker semi-empirical binding energy equation and its applications – Nuclear shell model – Shell Model: Single particle model with square well, harmonic oscillator and spin-orbit potentials, Collective model, Nilsson model. Energy levels and calculation of angular momentum – Collective model. **UNIT –IV:** Nuclear Reactions: Types of nuclear reactions – Compound nuclear	NIL	No Change in syllabus	Based on the feedback received from Faculty

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	theory – Briet Wigner formula. **UNIT – V:** Nuclear interactions: Direct and compound nuclear reaction mechanisms-cross sections in terms of partial wave amplitudes–compound nucleus–Scattering Matrix–Reciprocity theorem–Breit- Wigner one – level formula-Resonance scattering. **Text Books** Concepts of Nuclear Physics, B. L. Cohen (Tata McGrawHill), 2001. Nuclear Physics - An Introduction, S. B. Patel., Springer, 2006. Subatomic Physics, Frauenfelder and Hanley(Prentice-Hall), 2001. Nuclear Physics, I.Kaplan, 2001. Nuclear Radiation Detectors, S. S. Kapoor, V. S.Ramamurthy. Tata Mc Graw Hill, 2008		reactions – Nuclear cross section – Resonance theory – Briet Wigner formula. **UNIT – V:** Nuclear interactions: Direct and compound nuclear reaction mechanisms- cross sections in terms of partial wave amplitudes–compound nucleus–Scattering Matrix–Reciprocity theorem–Breit- Wigner one – level formula- Resonance scattering. **Text Books** Concepts of Nuclear Physics, B. L. Cohen (Tata McGrawHill), 2001. Nuclear Physics - An Introduction, S. B. Patel., Springer, 2006. Subatomic Physics, Frauenfelder and Hanley(Prentice-Hall), 2001. Nuclear Physics, I.Kaplan, 2001. Nuclear Radiation Detectors, S. S. Kapoor, V. S.Ramamurthy. Tata Mc Graw Hill, 2008			

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25PHY304 – Nuclear Physics-II

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY304 Nuclear Physics-II 4-0-0-0	**Unit – I:** Nuclear Decays: Nuclear transformations – Radioactive decay – Alpha decay – Gamow"s theory – Beta decay – Fermi theory –Selection rules – Interaction of gamma radiation with matter – Photo electric effect; – Compton scattering – Pair production. **UNIT – II:** Nuclear Accelerators: Introduction – Linear accelerators – Drift tube and Wave guide accelerators – Low energy circular accelerators – Cyclotron and Betatron – High energy circular accelerators – Synchrotron and Microtron **UNIT – III:** Nuclear Reactors: Nuclear fission and fusion reactions – Nuclear chain reactions – Four factor formula – The critical size of a reactor – General aspects of reactor design – Classification of reactors – Power reactors (elementary aspects only) **UNIT – IV:** Nuclear Structure: Problem of Nucleon Nucleon Interactions and Nuclear Forces, Nuclear Models and Nuclear Matter, Electromagnetic and Weak Interactions.	25PHY304 Nuclear Physics-II 4-0-0-0	**Unit – I:** Nuclear Decays: Nuclear transformations – Radioactive decay – Alpha decay – Gamow"s theory – Beta decay – Fermi theory –Selection rules – Interaction of gamma radiation with matter – Photo electric effect; – Compton scattering – Pair production. **UNIT – II:** Nuclear Accelerators: Introduction – Linear accelerators – Drift tube and Wave guide accelerators – Low energy circular accelerators – Cyclotron and Betatron – High energy circular accelerators – Synchrotron and Microtron **UNIT – III:** Nuclear Reactors: Nuclear fission and fusion reactions – Nuclear chain reactions – Four factor formula – The critical size of a reactor – General aspects of reactor design – Classification of reactors – Power reactors (elementary aspects only) **UNIT – IV:** Nuclear Structure: Problem of Nucleon Nucleon Interactions and Nuclear Forces, Nuclear Models and Nuclear Matter, Electromagnetic and Weak Interactions.	NIL	No Change in syllabus	Based on the feedback received from Faculty

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	UNIT – V: Experimental methods: Gamma-ray spectroscopy, conversion-electron and charged-particle spectroscopy associated with nuclear reactions and Coulomb excitation, Compton-suppressed Ge detectors, multiplicity filter, Neutron detectors, Sector field electron spectrometer, mini-range spectrometer, Recoll mass- separator, Advanced detector arrays-INGA, GAMMASPHERE and EUROBALL etc. **Text Books** Concepts of Nuclear Physics, B. L. Cohen (Tata McGrawHill), 2001. Nuclear Physics - An Introduction, S. B. Patel., Springer, 2006. Subatomic Physics, Frauenfelder and Hanley(Prentice-Hall), 2001. Nuclear Physics, I.Kaplan, 2001. Nuclear Radiation Detectors, S. S. Kapoor, V. S.Ramamurthy. Tata Mc Graw Hill, 2008.		**UNIT – V:** Experimental methods: Gamma-ray spectroscopy, conversion-electron and charged-particle spectroscopy associated with nuclear reactions and Coulomb excitation, Compton-suppressed Ge detectors, multiplicity filter, Neutron detectors, Sector field electron spectrometer, mini-range spectrometer, Recoll mass- separator, Advanced detector arrays-INGA, GAMMASPHERE and EUROBALL etc. **Text Books** Concepts of Nuclear Physics, B. L. Cohen (Tata McGrawHill), 2001. Nuclear Physics - An Introduction, S. B. Patel., Springer, 2006. Subatomic Physics, Frauenfelder and Hanley(Prentice-Hall), 2001. Nuclear Physics, I.Kaplan, 2001. Nuclear Radiation Detectors, S. S. Kapoor, V. S.Ramamurthy. Tata Mc Graw Hill, 2008.			

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25PHY205 – Liquid Crystals-I

Course Details	Existing Syllabus with Text Books and Reference Books	Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY205 **LIQUID CRYSTALS-I** 4-0-0-0 Credits: 4	**UNIT – I: Chemical Construction:** Thermo tropic liquid crystals, Nematics, Smectics, Cholestrics, and Disc like molecules, linear molecules, lyotropic liquid crystals, monolayer and bilayer arrangements, monotropic and enatiotropic liquid crystals, bridging groups. **UNIT – II: Microscopic investigations including basic concepts:** Phenomenology and morphology – polymorpholism-boundary effects-textures- homogeneous and homeotropic textures of nematic and smectic phases. **UNIT – III: Theories of liquid crystalline state:** Swan theory- Continuem theory -Maier-Sauté theory (Mean field theory) – Landau-de Gennes theory –Pre transitional effects-Mc Millan theory of septic A phase and its developments. **UNIT – IV: Electric and Magnetic field**	**25PHY205** **LIQUID CRYSTALS-I** 4-0-0-0 Credits: 4	**UNIT – I: Chemical Structure and Classification** Thermotropic and lyotropic liquid crystals, Nematic, Smectic, Cholesteric. Disc like molecules, linear molecules, lyotropic liquid crystals, monolayer and bilayer arrangements, monotropic and enatiotropic liquid crystals, bridging groups. Role of bridging and terminal groups in mesophase stability **UNIT – II: Microscopic and Morphological Studies** Phenomenology and morphology – polymorpholism-boundary effects-textures- homogeneous and homeotropic textures of nematic and smectic phases.Orientation behaviors: homogeneous, homeotropic, and hybrid alignments **UNIT – III: Theoretical Approaches to Liquid Crystals** Swan theory- Continuem theory -Maier-Sauté theory (Mean field theory) – Landau-de Gennes theory –Pre transitional effects-Mc Millan theory of septic A phase and its developments. Pre-transitional behavior and fluctuation phenomena	**UNIT-I:** Role of bridging and terminal groups in mesophase stability **UNIT-II:** Orientation behaviors: homogeneous, homeotropic, and hybrid alignments **UNIT-III:** Pre-transitional behavior and fluctuation phenomena	10%	Based on the feedback received from the faculty and scholars

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	effects: Elastic deformations (Fredrick's deformation) – Magnetic field effects (temperature) on nematics and smetics – Electric field effects- Domains – DSM – Loops –Electro hydrodynamic instabilities. **UNIT – V: Polarizing Microscopy:** The Polarizing Microscope, Basic Liquid Crystal Optics, Uniaxial Phases, Biaxiality, Conoscopy. **Textbooks:** 1. Introduction to Liquid Crystals:EditorsE.P.Priestley et. Al.,PlenumPress,N.Y. 2. Hand book of Liquid Crystals: Hans Kelker et. Al. **Reference Books:** 1. The molecular Physics of Liquid Crystals: G.W.Grayet.al. 2. Liquid Crystals: S.Chandrasekhar. 3. Textures of Liquid Crystals: Ingo Dierking		**UNIT – IV: Field-Induced Effects and Dynamics** Elastic deformations (Fredrick's deformation) – Magnetic field effects (temperature) on nematics and smetics – Electric field effects- Domains – DSM – Loops –Electro hydrodynamic instabilities.Electro hydro dynamic and thermo mechanical instabilities. **UNIT – V: Polarizing Optical Techniques** The Polarizing Microscope, Basic Liquid Crystal Optics, Uniaxial Phases, Biaxiality, Conoscopy. Recent advancements in LC texture imaging techniques. **Textbooks** 1. Introduction to Liquid Crystals — E. B. Priestley, P. J. Wojtowicz, P. Sheng — Plenum Press, New York — 1975 2. Handbook of Liquid Crystals — Hans Kelker, Rolf Hatz, Christa Schumann — Verlag Chemie, Weinheim — 1980 **Reference Books** 1. The Molecular Physics of Liquid Crystals — G. W. Gray — Academic Press, London — 1979 2. Liquid Crystals — S. Chandrasekhar — Cambridge University Press — 1992 (2nd Edition)	**UNIT-IV:** Electro hydro dynamic and thermo mechanical instabilities. **UNIT-V:** Recent advancements in LC texture imaging techniques.		

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25PHY305 – Liquid Crystals-II

Course Details	Existing Syllabus with Text Books and Reference Books	Course Details	Revised/ProposedSyllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY305 **LIQUID CRYSTALS-II** 4-0-0-0 Credits: 4	**UNIT – I: Thermodynamic Properties:** Theories of phase transitions-pre transitional phenomena – Calorimetric measurements – Molar heat – Transitional entropy and enthalpy. **UNIT – II: Optical Properties:** Birefringence –Rayleigh's scattering – UV and Visible absorption spectroscopy. **UNIT – III: Liquid Crystal displays:** Electro optic phenomena – Field induced birefringence – Twisted nematic – Guest – Host effect – Cholestrics to nematic trasition – Storage mode – Display life – Alignment of liquid crystal, homogeneous and homeotropic. **UNIT – IV: Technical Applications:** Thermography – Elecro optic display devices – Holography – Interferometry.	**25PHY305** **LIQUID CRYSTALS-II** 4-0-0-0 Credits: 4	**UNIT – I: Thermodynamic Properties** Theories of phase transitions-pre transitional phenomena – Calorimetric measurements – Molar heat – Transitional entropy and enthalpy. Influence of molecular structure on thermal behaviour. **UNIT – II: Optical Properties** Birefringence –Rayleigh's scattering – UV and Visible absorption spectroscopy. Temperature dependence of optical transitions. **UNIT – III: Liquid Crystal Displays** Electro optic phenomena – Field induced birefringence – Twisted nematic – Guest – Host effect – Cholestrics to nematic trasition – Storage mode – Display life – Alignment of liquid crystal, homogeneous and homeotropic. Lifespan and degradation mechanisms in display devices. **UNIT – IV: Emerging Applications** Thermography – Elecro optic display devices – Holography – Interferometry. Emerging applications: sensors,	**UNIT-I:** Influence of molecular structure on thermal behaviour. **UNIT-II:** Temperature dependence of optical transitions. **UNIT-III:** Lifespan and degradation mechanisms in display devices. **UNIT-IV:** Emerging applications: sensors, tunable photonic devices.	10%	Based on the feedback received from the faculty and scholars

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	UNIT – V: Twist Grain BoundaryPhases: The TGBA Phase, Textures of planar anchoring conditions, hometropic anchoring conditions, Suppression of TGBA texture, TGBC and TGBCA phases. **Reference Books:** 1. Introduction to Liquid Crystals:EditorsE.P.Priestley et. Al., Plenum Press,N.Y. 2. Hand book of Liquid Crystals: Hans Kelker et. Al. 3. The molecular Physics of Liquid Crystals: G.W.Grayet.al. 4. Liquid Crystals: S.Chandrasekhar. 5. Textures of Liquid Crystals: IngoDierking		tunablephotonic devices. **UNIT – V: Twist Grain Boundary Phases** The TGBA Phase, Textures of planar anchoring conditions, hometropic anchoring conditions, Suppression of TGBA texture, TGBC and TGBCA phases. Chirality, frustration, and defect structures in TGB phases. **Textbooks** 1. Introduction to Liquid Crystals — E. B. Priestley, P. J. Wojtowicz, P. Sheng — Plenum Press, New York — 1975. 2. Handbook of Liquid Crystals — Hans Kelker, Rolf Hatz, Christa Schumann — Verlag Chemie, Weinheim — 1980. **Reference Books** 1. The Molecular Physics of Liquid Crystals — G. W. Gray — Academic Press, London — 1979. 2. Liquid Crystals — S. Chandrasekhar — Cambridge University Press — 1992 (2nd Edition). 3. Textures of Liquid Crystals — Ingo Dierking — Wiley-VCH, Weinheim — 2003	**UNIT-V:** Chirality, frustration, and defect structures in TGB phases.		

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25PHY206 – Physics of Solar Engineering

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY206 PHYSICS OF SOLAR CELLS 4-0-0-0 Credits: 4	**UNIT- I: FUNDAMENTALS OF SOLAR CELLS** Energy scenario - Renewable Energy sources - Economic Analysis of Renewable Energy System - Solar radiation: Solar constant - Solar Spectra - Air Mass - Global radiation -Position of the Sun. Insolation Physics of Solar cells: Fundamental Properties of Semiconductors - conversion of solar energy, photochemical conversion of solar energy - photovoltaic conversion - photo physics of semiconductors - photocatalysis - Band model - Doping - Semiconductor types - absorption of light - recombination - p-n junction - Solar cells - Solar cell parameters - Spectral response - Upper limits of cell parameters - Thermodynamic limit-the Schokley-Quiesser limit - effect of temperature - effect of parasitic resistances. **UNIT- II: TECHNIQUES GOVERNING DIFFERENTIAL EQUATIONS AND DISCRETISATION** Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications - Basics of Heat Transfer, Fluid flow – Mathematical description of fluid flow and heat transfer – Classification of partial differential equations – Initial and Boundary conditions - Taylor's Series -	**25PHY206** PHYSICS OF SOLAR ENGINEERING 4-0-0-0 Credits: 4	**UNIT- I: FUNDAMENTALS OF SOLAR CELLS** Foundational Principles: Semiconductor Physics- Photovoltaic Effect - p-n Junctions - Solar Cell Parameters - Loss Mechanisms and Efficiency Limits. Solar Cell Technologies and Materials: First-Generation Solar Cells - Second-Generation Solar Cells - Third-Generation Solar Cells Advanced Topics and Characterization: Advanced Device Architectures - Characterization Techniques - Modeling and Simulation - Practical Applications and Systems: **UNIT- II: Core Foundations and Theoretical Analysis** Ordinary Differential Equations: One-Step Methods - Multi-Step Methods - Stiffness - Stability and Convergence - Error Analysis. Partial Differential Equations (PDEs): Classification of PDEs - Function Spaces - Banach and Hilbert spaces - Weak Formulation - Finite Element Method - Variational Principles - Taylor series expansions - Equivalence Theorem- Elliptic-Parabolic – Hyperbolic - Conservation	**UNIT-I:** Advanced Topics and Characterization: Advanced Device Architectures - Characterization Techniques - Modeling and Simulation - Practical Applications and Systems: **UNIT-II:** Galerkin Method - Element Formulations - Error Estimation: Céa's Lemma - Linear System Solvers - Nonlinear Equations - Computational Tools.	20%	Based on the feedback received from Faculty and scholars

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	Uniform and non-uniform Grids - Numerical Errors. **UNIT- III: SOLAR PV TECHNOLOGIES (qualitative):** Description of the photovoltaic effect – Electrical characteristics calibration and efficiency measurement. First generation: Silicon wafer-based technology: Design of Crystalline Silicon Solar Cells - loss mechanism - silicon feed stock - production of silicon wafers - Manufacturing process of c-Si solar cells - high efficiency approaches - PERL and PERC cells - interdigitated back contacts – TOP Con - heterojunction solar cells - lab to industry requirements. Second generation: Thin film technologies: Merits and demerits of thin film technologies - Transparent conducting oxides - GaAs, amorphous-Si, CdTe and CIGS solar cells, a-Si and Tandem solar cells, Multi junction cells, Emerging PV: DSSC - Organic solar cells -Perovskite -Quantum Dots. Third generation/emerging PV technologies: Organic PV - organic-inorganic hybrid solar cells - Quantum-dot - Hot-carrier - Up conversion and down conversion **UNIT- IV: HIGH EFFICIENCY CONCEPTS IN SOLAR CELLS:** Heterojunction solar cells Second generation technology: Thin film solar cells - merits and demerits Transparent conducting oxides - the III-V PV technology - thin film Si technology -		properties - Galerkin Method - Element Formulations - Error Estimation: Céa's Lemma - Linear System Solvers - Nonlinear Equations - Computational Tools. **UNIT- III: SOLAR PV TECHNOLOGIES (qualitative)** Foundational Principles: Solar Spectrum - Photovoltaic Effect - Solar Cell Parameters - open-circuit voltage (Voc), short-circuit current (Jsc), and fill factor (FF) - Efficiency Limits - Shockley-Queisser limit, First- and Second-Generation Technologies: Crystalline Silicon (c-Si) - Thin-Film Solar Cells - Cadmium Telluride (CdTe) and Copper Indium Gallium Selenide (CIGS). Manufacturing and Cost. Third-Generation and Emerging Technologies: Perovskite Solar Cells - Organic and Dye-Sensitized Solar Cells (DSSC) - Multi-Junction and Tandem Solar Cells - Concentrated Photovoltaics (CPV) - Module and System Design - Energy Storage Integration - Environmental and Economic Impact: **UNIT- IV: HIGH EFFICIENCY CONCEPTS IN SOLAR CELLS:** Thermodynamics and Fundamental Limits: Shockley-Queisser Limit Revisited - Beyond the Shockley-Queisser Limit - hot carrier solar cells - multi-exciton generation (MEG) in	**UNIT-III:** Module and System Design - Energy Storage Integration - Environmental and Economic Impact: **UNIT-IV:** Heterojunctions and Interface Passivation - heterojunctions with intrinsic thin-layer (HIT) solar cells - Back-Contact Solar		

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	Chalcogenide solar cells - Organic and inorganic photovoltaics - efficiency of DSSCs. Hybrid organic-inorganic solar cells Third generation concepts: Multi junction solar cells - Spectral conversion - Multi- exciton generation - Intermediate band solar cells - Hot carrier solar cells Module manufacturing: Interconnection of cells series and parallel connections-silicon module production - PV systems: Standalone systems - grid-connected systems - hybrid systems - micro grids - smart grids - specific applications **UNIT- V: ENERGY LEVELS AND SPECTRA - CHARACTERISTICS** Basic characteristics solar cell light intensity - temperature and light spectra the short-circuit current (ISC) - open-circuit voltage (VOC) - fill factor (FF) - solar energy conversion efficiency (η) - Influence of the series resistance (Rs) - parallel resistance (Rp) - Principle work with various kinds of load resistances - function pyranometer - quantum efficiency in solar cells - Errors in measurements - Statistical analysis of data - Regression analysis – correlation - estimation of uncertainty data - experiments factors and protocols. Polarization rotation - Effective band gap engineering -Vibrations - Rotational Energy of Spherical - Rotational Raman - IR Spectra of linear molecules - Influence of Nuclear Spin on Rotational Raman Spectrum – Rotation - Software for fitting: Peak fit, Origin, Software for spectra and vibration analysis: Crystal sleuth, Raman and IR mode calculation, Polarization analysis.		quantum dots - Thermodynamics of Solar Energy Conversiony. Light Management and Advanced Device Architectures: Light Trapping - surface texturing- plasmonic nanoparticles-photonic crystals - Anti-Reflection Coatings -Heterojunctions and Interface Passivation - heterojunctions with intrinsic thin-layer (HIT) solar cells - Back-Contact Solar Cells - Interdigitated Back Contact (IBC) solar cells, Multi-Junction Solar Cells - tandem solar cells - Perovskite Solar Cells. **UNIT- V: ENERGY LEVELS AND SPECTRA - CHARACTERISTICS:** Quantum Mechanical Foundations: Advanced Quantum Mechanics - Angular Momentum - Symmetry and Group Theory. Atomic Spectra - Atomic Structure - Zeeman and Stark Effects - Radiative Transitions and Selection Rules - Molecular Spectra - Born-Oppenheimer Approximation - Rotational and Vibrational Spectra - Electronic Spectra and Franck-Condon Principle - Franck-Condon principle - Raman Spectroscopy- Lasers and Spectroscopic Techniques - Spectroscopic Characterization - Relativistic and Quantum Electrodynamics (QED) Effects - Computational Spectroscopy.	Cells - Interdigitated Back Contact (IBC) solar cells, Multi-Junction Solar Cells - tandem solar cells - Perovskite Solar Cells. **UNIT-V:** Raman Spectroscopy- Lasers and Spectroscopic Techniques - Spectroscopic Characterization - Relativistic and Quantum Electrodynamics (QED) Effects - Computational Spectroscopy.		

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	Textbooks: 1. Duffie, J.A., and Beckman, W.A. Solar Energy Thermal Process - 4 th Edition (2013), John Wiley and Sons, New York, ISBN: 978-0-470-87366-3, Solar Energy Laboratory, University of Wisconsin-Madison, pp. 944. 2. M. Stix, The Sun, An Introduction, Second Edition, Springer 2002. 3. Jenny Nelson, The Physics of Solar Cells. Imperial College Press, 2003 4. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications (2011), 2nd edition, PHI Publications, pp. 512. 5. Sukhatme S.P. J K Nayak, Solar Energy, Tata McGraw Hills P Co., ISBN: 9789352607112, 4th Edition, 2017, pp. 568. 6. C. Julian Chen, Physics of Solar Energy (2011), ISBN: 978-1-118-04832-0, pp. 352. 7. K. Mertens, Photovoltaics: Fundametals, Technology and Practice, John Wiley & Sons Ltd (2014) 8. Handbook of Photovoltaic Science and Engineering 2nd Ed. , A. Luque, S. Hegedus (editors), John Wiley & Sons Ltd (2011) 9. A. Smets, K. Jager, O. Isabella, R. V. Swaaij, M. Zeman, Solar Energy: The physics and engineering of photovoltaic conversion, technologies and systems, UIT Cambridge Ltd. (2016). 10. S.R. Wenham, M. Green, M.E. Watt, R. Corkish, A. Sproul, Applied Photovoltaics ? 2nd Edition (2009)		**Textbooks:** 1. Duffie, J.A., and Beckman, W.A. Solar Energy Thermal Process - 4 th Edition (2013), John Wiley and Sons, New York, ISBN: 978-0-470-87366-3, Solar Energy Laboratory, University of Wisconsin-Madison, pp. 944. 2. M. Stix, The Sun, An Introduction, Second Edition, Springer 2002. 3. Jenny Nelson, The Physics of Solar Cells. Imperial College Press, 2003 4. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications (2011), 2nd edition, PHI Publications, pp. 512. 5. Sukhatme S.P. J K Nayak, Solar Energy, Tata McGraw Hills P Co., ISBN: 9789352607112, 4th Edition, 2017, pp. 568. 6. C. Julian Chen, Physics of Solar Energy (2011), ISBN: 978-1-118-04832-0, pp. 352. 7. K. Mertens, Photovoltaics: Fundametals, Technology and Practice, John Wiley & Sons Ltd (2014) 8. Handbook of Photovoltaic Science and Engineering 2nd Ed. , A. Luque, S. Hegedus (editors), John Wiley & Sons Ltd (2011) 9. A. Smets, K. Jager, O. Isabella, R. V. Swaaij, M. Zeman, Solar Energy: The physics and engineering of photovoltaic conversion, technologies and systems, UIT Cambridge Ltd. (2016). 10. S.R. Wenham, M. Green, M.E. Watt, R. Corkish, A. Sproul, Applied Photovoltaics ? 2nd Edition (2009) 11. Chetan Singh Solanki, Solar			

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	11. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and applications, 3rd Edition, PHI Learning Pvt. Ltd. (2019). 12. Jenny Nelson, The Physics of Solar Cells, Imperial College Press (2003). 13. Peter Wurfel, Physics of solar cells: from principles to advanced concepts, 2nd Edition, WileyVCH (2009). **Reference Books:** 1. Chemical Applications of Group Theory : F.A. Cotton. 2. Fundamentals of Molecular Spectroscopy : C.N. Banwell. 3. Introduction to Molecular Spectroscopy : G.M. Barrow. 4. Modern Spectroscopy : J.M. Hollas. 5. D. A. Neamen and D. Biswas, Semiconductor Physics and Devices 6. R.F. Pierret, Semiconductor Device Fundamentals 7. SM Sze and Kwok K Ng, Physics of semiconductor devices, third edition ,John Wiley & Sons (2007)		Photovoltaics: Fundamentals, Technologies and applications, 3rd Edition, PHI Learning Pvt. Ltd. (2019). 12. Jenny Nelson, The Physics of Solar Cells, Imperial College Press (2003). 13. Peter Wurfel, Physics of solar cells: from principles to advanced concepts, 2nd Edition, WileyVCH (2009). **Reference Books:** 1. Chemical Applications of Group Theory : F.A. Cotton. 2. Fundamentals of Molecular Spectroscopy : C.N. Banwell. 3. Introduction to Molecular Spectroscopy : G.M. Barrow. 4. Modern Spectroscopy : J.M. Hollas. 5. D. A. Neamen and D. Biswas, Semiconductor Physics and Devices 6. R.F. Pierret, Semiconductor Device Fundamentals 7. SM Sze and Kwok K Ng, Physics of semiconductor devices, third edition ,John Wiley & Sons (2007)			

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25PHY306 – Advanced Solar Energy Storage Technologies

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY309 ADVANCED SOLAR ENERGY STORAGE TECHNOLOGIES 4-0-0-0 Credits: 4	**UNIT- I: ENERGY STORAGE** Necessity of storage for solar energy - Chemical energy storage - Thermal energy storage - Thermal Flywheels - Compressed air energy storage- Rechargeable batteries - Thermal Storage Concepts - Materials for Sensible and Latent Heat Energy Storage. Organic, Inorganic Eutectic Materials, Materials for Low and High Temperature Storage Applications. Chemical storage Concepts. **UNIT- II: SOLAR WATER HEATING SYSTEMS** Thermal storage – Types – Modelling of thermal storage units – Modelling of phase change storage system - Modelling using porous medium approach - Integral Collector Storage System - Thermosyphon System - Open Loop, Drain Down, Drain Back, Antifreeze Systems - Refrigerant Solar Water Heaters - Solar Heated Pools - Solar Heated Hot Tubs and Spas. Basics of absorption cooling - Principle of absorption cooling - Solar operation of vapour absorption refrigeration cycle - Open cycle absorption / desorption solar	**25PHY309** ADVANCED SOLAR ENERGY STORAGE TECHNOLOGIES 4-0-0-0 Credits: 4	**UNIT- I: Solar ENERGY STORAGE** Foundational Principles: Solar PV Systems - Maximum Power Point Tracking-Thermodynamics of Energy Storage – Electrochemistry-Electrochemical Energy Storage-Lithium-Ion Batteries-Redox Flow Batteries -Solid-State Batteries. Thermal Energy Storage: Sensible and Latent Heat Storage -Phase Change Materials (PCMs)- hermochemical Storage - Mechanical and Chemical Storage -Pumped Hydro Storage - Hydrogen as an Energy Carrier - Hybrid Energy Systems - Grid Integration and Smart Grids - Modeling and Simulation - Economic and Policy Aspects. **UNIT- II: SOLAR Thermal applications:** Foundational Principles: Solar Radiation - Heat Transfer and Thermodynamics - Optics and Materials Science - design of solar selective coatings and anti-reflection coatings-Flat-Plate Collectors - Concentrating Solar Power (CSP) Systems - parabolic trough collectors, solar power towers - dish Stirling systems - Solar Thermal Energy Storage - sensible heat storage, latent heat storage - thermochemical storage- Industrial Process Heat (SHIP) - Solar Cooling and Desalination -	**UNIT-I:** Hydrogen as an Energy Carrier - Hybrid Energy Systems - Grid Integration and Smart Grids - Modeling and Simulation - Economic and Policy Aspects. . **UNIT-II:** Solar Thermal Energy Storage - sensible heat storage, latent heat storage - thermochemical storage- Industrial Process Heat (SHIP) - Solar Cooling and Desalination - absorption refrigeration cycles - Solar Passive Architecture -	30%	Based on the feedback received from Facultyand scholars

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	cooling alternatives – Lithium Bromide-Water absorption System – Aqua-ammonia absorption system. **UNIT- III: SOLAR SPACE CONDITIONING SYSTEMS** Liquid Type Solar Heating System With / Without Storage - Heat Storage Configurations – Heat Delivery Methods - Air-Type Solar Heating Systems - Solar Refrigeration and Air Conditioning. Solar Parabolic trough - Transformation Technologies for Waste Treatment – Classification and characteristics of Composite materials – Biomass pyrolysis – Bio energy. **UNIT- IV: OTHER SOLAR APPLICATIONS** Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – domestic, community – Solar pond – Solar drying-solar chimney-solar thermal electricity conversion. Introduction – Necessity for desalination – Study on various desalination techniques – Comparison between conventional and solar desalination – Basics of solar still - Simple solar still – Material problems in solar still – Solar disinfection and its		absorption refrigeration cycles - Solar Passive Architecture - Modeling and Simulation - CFD. **UNIT- III: SOLAR SPACE CONDITIONING SYSTEMS** Solar Radiation and Optics - solar selective coatings - glazing materials Solar Thermal Collectors - flat-plate collectors - Heat Transfer and Fluid Dynamics - Solar Cooling Technologies - Absorption Refrigeration Cycles - lithium bromide-water - ammonia-water - Desiccant Cooling Systems - Adsorption Refrigeration - Thermal Energy Storage (TES) - Thermochemical storage - System Integration and Control -Building Simulation and Modeling - TRNSYS, EnergyPlus, MATLAB - Economics and Environmental Impact. **UNIT- IV: OTHER SOLAR APPLICATIONS** Solar Thermal Desalination and Water Treatment: Fundamentals of Desalination - Solar Stills - design, performance, and modeling of various solar still - Humidification-Dehumidification (HDH) Systems - Membrane Distillation (MD) Solar Industrial Process Heat - Process Heat Analysis - Collector Integration - heat exchangers - Pinch Analysis - Case Studies: Solar Cooking and Drying - Solar Cooker Design - box cookers, parabolic cookers, and panel cookers -	Modeling and Simulation - CFD. **UNIT-III:** Thermal Energy Storage (TES) - Thermochemical storage - System Integration and Control -Building Simulation and Modeling - TRNSYS, EnergyPlus, MATLAB - Economics and Environmental Impact. **UNIT-IV:** - Hybrid Systems - solar thermal with conventional heat sources - Techno-Economic Analysis - Modeling and Simulation - Materials Research - AI-Powered Performance Prediction for Machine Vision.		

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	methods – Case studies on various desalination techniques. Introduction – Types of solar cookers – Advantages and disadvantages - Box type – Parabolic dish cooker - Performance evaluation of solar cookers – Testing of a solar cooker – Applications of solar cooking - Case studies **UNIT- V: SOLAR PASSIVE ARCHITECTURE** Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain – indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - energy efficient landscape design - thermal comfort - Application of economic methods. **Text Books:** 1. Versteeg and Malalasekera, N, "An Introduction to computational Fluid Dynamics the Finite Volume Method," Pearson Education, Ltd., Second Edition, 2014. 2. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid		Solar Dryers - Solar Cooker Modeling - Hybrid Systems - solar thermal with conventional heat sources - Techno-Economic Analysis - Modeling and Simulation -Materials Research - AI-Powered Performance Prediction for Machine Vision. **UNIT- V: SOLAR PASSIVE ARCHITECTURE for Green H_2 production:** Advanced Passive Solar Architecture - Green Hydrogen Production – electrolysis – photoelectrochemical water splitting and biological hydrogen production - Energy and Mass Transfer- Thermal Management of Electrolyzers - pre-heat water - passively cool Integration with Building Design - Natural Ventilation for Hydrogen Facilities - solar chimneys - Building Energy Simulation - techno-economic analysis - Computational Fluid Dynamics (CFD) - Life-Cycle Assessment (LCA) - Experimental Design on solar thermal applications. **Text Books:** 1. Versteeg and Malalasekera, N, "An Introduction to computational Fluid Dynamics the Finite Volume Method," Pearson Education, Ltd., Second Edition, 2014. 2. Anderson, D.A., Tannehill, J.I., and	**UNIT-V:** Natural Ventilation for Hydrogen Facilities - solar chimneys - Building Energy Simulation - techno-economic analysis - Computational Fluid Dynamics (CFD) - Life-Cycle Assessment (LCA) - Experimental Design on solar thermal applications.		

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	Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984 3. Subas, V.Patankar, "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980. 4. Tapan K. Sengupta, "Fundamentals of Computational Fluid Dynamics" Universities Press, 2011. 32 5. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995. 6. HP Garg and J Prakash: Solar Energy: Fundamentals and Applications, Tata McGraw Hill, 2010. 7. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002. 8. Mills .A.F, Ganesan V.," Heat Transfer", 2nd ed., Pearson, 2009. 9. Minkowycz .W.J, Sparrow .E.M, Murthy J.Y, "Handbook of Numerical Heat Transfer", 2nd ed., Wiley, 2006. 10. Kreith .F, Bohn .M.S, "Principles of Heat Transfer", 6th ed., Thomson, 2001. 11. Venkateshan .S.P, "Heat Transfer", Ane Books Pvt Ltd , New Delhi. 2009. **REFERENCE BOOKS:** 1. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, Taylor and Francis, 2000 2. Chetan Singh Solanki, Solar Photovoltatics – Fundamentals, Technologies and Applications, PHI		Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984 3. Subas, V.Patankar, "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980. 4. Tapan K. Sengupta, "Fundamentals of Computational Fluid Dynamics" Universities Press, 2011. 32 5. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995. 6. HP Garg and J Prakash: Solar Energy: Fundamentals and Applications, Tata McGraw Hill, 2010. 7. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002. 8. Mills .A.F, Ganesan V.," Heat Transfer", 2nd ed., Pearson, 2009. 9. Minkowycz .W.J, Sparrow .E.M, Murthy J.Y, "Handbook of Numerical Heat Transfer", 2nd ed., Wiley, 2006. 10. Kreith .F, Bohn .M.S, "Principles of Heat Transfer", 6th ed., Thomson, 2001. 11. Venkateshan .S.P, "Heat Transfer", Ane Books Pvt Ltd , New Delhi. 2009. **REFERENCE BOOKS:** 1. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, Taylor and Francis, 2000 2. Chetan Singh Solanki, Solar			

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	Learning Private limited 2011 3. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, Tata McGraw Hill, 2008. 4. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006 5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2010. 6. Das .S.K, "Fundamentals of Heat and Mass Transfer", Narosa, 2010. 7. Duffie .J.A, Beckman W. A. "Solar Engineering of Thermal Processes", 3rd ed., Wiley, 2006. 8. Sachdeva .R.C, "Fundamentals of Heat and Mass Transfer", 4th ed., New Age, 2010. 9. Ghoshdastidar .P.S, "Heat Transfer", Oxford University Press, 2004.2.		Photovoltatics – Fundamentals, Technologies and Applications, PHI Learning Private limited 2011 3. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, Tata McGraw Hill, 2008. 4. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006 5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2010. 6. Das .S.K, "Fundamentals of Heat and Mass Transfer", Narosa, 2010. 7. Duffie .J.A, Beckman W. A. "Solar Engineering of Thermal Processes", 3rd ed., Wiley, 2006. 8. Sachdeva .R.C, "Fundamentals of Heat and Mass Transfer", 4th ed., New Age, 2010. 9. Ghoshdastidar .P.S, "Heat Transfer", Oxford University Press, 2004.2.			

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25PHY307 - Aeronomy

Existing Course Details	Existing Syllabus with Text Books and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Text Books and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY308 Aeronomy 4-0-0-0 Credits: 4	**UNIT – I : NEUTRAL ATMOSPHERE** Structure and Composition Nomenclature-Thermal structure of the atmosphere. Hydrostatic equation of the atmospheric structure. Scale height and geopotential height. Exosphere. Atmospheric composition. Dissociation and diffusive separation and thermospheric composition. Heat balance and temperature profile of thermosphere. **UNIT – II: CHEMICAL CONCEPTS IN ATMOSPHERE** Thermodynamic considerations – Enthalpy . Elementary chemical kinetics- Reaction rate constants and chemical life time of species. Unimolecular, bimolecular and termolecular reactions. Effect of dynamics on chemical species. **UNIT – III: IONIZED ATMOSPHERE** Photochemical processes in the ionosphere Introduction to ionosphere – discovery. Continuity equation and photochemical equilibrium. Theory of photo-ionization and Chapman production function. Chemical	25PHY308 Aeronomy 4-0-0-0 Credits: 4	**UNIT – I : Neutral Atmosphere** Structure and Composition Nomenclature-Thermal structure of the atmosphere. Hydrostatic equation of the atmospheric structure. Scale height and geopotential height. Exosphere. Atmospheric composition. Dissociation and diffusive separation and thermospheric composition. Heat balance and temperature profile of thermosphere, Influence of space weather events on the thermosphere. **UNIT – II: Chemical Concepts In Atmosphere** Thermodynamic considerations – Enthalpy. Elementary chemical kinetics- Reaction rate constants and chemical life time of species. Unimolecular, bimolecular and intermolecular reactions. Effect of dynamics on chemical species, Ion-neutral chemistry in the mesosphere and thermosphere. **UNIT – III: Ionized Atmosphere** Photochemical processes in the ionosphere Introduction to ionosphere – discovery. Continuity equation and photochemical equilibrium. Theory of photo-ionization and Chapman production function. Chemical	**UNIT – I :** Influence of space weather events on the thermosphere. **UNIT – II:** Ion-neutral chemistry in the mesosphere and thermosphere. **UNIT – III:** Data assimilation techniques using GNSS and satellite measurements.	10%	Based on the feedback received from Faculty and scholars

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	recombination and electron density. Solar radiation and production of ionospheric layers. **UNIT – IV: IONIZED ATMOSPHERE** Loss reactions Different types of recombination processes. Chemistry of E and F1 regions. D region balance equations. D region chemistry – formation of water cluster ions. Electron attachment and negative ions. Positive and negative ion schemes of D region. Linear and square law loss formulae and splitting of F layer. Vertical transport, ambipolar diffusion and F2 peak. Diffusion between ionosphere and protonosphere. Airglow. **UNIT – V: MORPHOLOGY** Geographical and temporal structure of the ionosphere – Diurnal, seasonal and solar cycle variations of D, E and F regions and F region anomalies. Solar flare effects Sudden Ionospheric Disturbances (SIDs).		recombination and electron density. Solar radiation and production of ionospheric layers, Data assimilation techniques using GNSS and satellite measurements. **UNIT – IV: Ionized Atmosphere** Loss reactions Different types of recombination processes. Chemistry of E and F1 regions. D region balance equations. D region chemistry – formation of water cluster ions. Electron attachment and negative ions. Positive and negative ion schemes of D region. Linear and square law loss formulae and splitting of F layer. Vertical transport, ambipolar diffusion and F2 peak. Diffusion between ionosphere and protonosphere. Airglow, AI-based prediction of ionospheric disturbances. **UNIT – V: Ionospheric Morphology & Disturbances** Geographical and temporal structure of the ionosphere – Diurnal, seasonal and solar cycle variations of D, E and F regions and F region anomalies. Solar flare effects Sudden Ionospheric Disturbances (SIDs), Ionospheric scintillation and its impact on communication/navigation systems, Space weather forecasting and ionospheric response, Role of geomagnetic storms and substorms in ionospheric morphology.	**UNIT – IV:** AI-based prediction of ionospheric disturbances. **UNIT – V: Ionospheric Morphology & Disturbances** Ionospheric scintillation and its impact on communication/navigation systems, Space weather forecasting and ionospheric response, Role of geomagnetic storms and substorms in ionospheric morphology.		

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	Reference Books 1."Introduction to Ionospheric Physics" by H.Rishbeth&O.K.Garriott 2."Aeronomy of the Middle Atmosphere" by Guy Brasseur &S.Solomon.		**Text Books** 1. Schunk, R.W., and Nagy, A.F. Ionospheres: Physics, Plasma Physics, and Chemistry (2nd Edition). Cambridge University Press, 2009. ISBN: 978-0521877060. 2. Rishbeth, H., and Garriott, O.K. Introduction to Ionospheric Physics. Academic Press, 1969. ISBN: 978-0125884011. 3. Brasseur, G.P., and Solomon, S. Aeronomy of the Middle Atmosphere (3rd Edition). Springer, 2005. ISBN: 978-1402032824. Reference Book 1. Schunk, R.W., and Sojka, J.J. Ionospheric Data Assimilation and Modeling. Springer, 2019. ISBN: 978-3319916328.			

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25PHY306 – Thin Film Technology and Applications

Existing Course Details	Existing Syllabus with Textbooks and Reference Books	Revised Course Details	Revised/Proposed Syllabus with Textbooks and Reference Books	Newly Added Topics wrt individual units	Percentage of syllabus updated in revision	Remarks from Stakeholders, if any
21PHY306 **THIN FILM TECHNOLOGY AND APPLICATIONS** 4-0-0-0 Credits: 4	**UNIT- I: Introduction of thin films** Preparation of Thin-films Kinetic aspects of Gases in a vacuum chamber - Classifications of vacuum ranges Production of vacuum - Pressure measurement in vacuum systems - Physical vapor deposition - Evaporation Techniques - Sputtering (RF & DC) - Pulsed Laser deposition Liquid Phase Epitaxy- Vapor Phase Epitaxy- Molecular Beam Epitaxy. **UNIT- II: Synthesis methods of thin films** Film growth and measurement of thickness, Thermodynamics and Kinetics of thin film formation - Film growth – five stages - Incorporation of defects and impurities in films - Deposition parameters and grain size - structure of thin films - Microbalance technique - quartz crystal monitor photometric - Ellipsometry and interferometers - Measurement of rate of deposition using rate meter - cleaning of substrate. **UNIT- III: Characterisations of thin films** Characterization, X-ray Diffraction (XRD) - SEM, Photoluminescence (PL) - Raman Spectroscopy, UV-Vis-IR	25PHY306 **THIN FILM TECHNOLOGY AND APPLICATIONS** 4-0-0-0 Credits: 4	**UNIT- I: Introduction of thin films** Preparation of Thin films - Different synthesis methods of the thin films-films Kinetic aspects of Gases in a vacuum chamber - Classifications of vacuum ranges Production of vacuum - Pressure measurement in vacuum systems - Physical vapor deposition - Evaporation Techniques - Sputtering (RF & DC) - Pulsed Laser deposition Liquid Phase Epitaxy- Vapor Phase Epitaxy- Molecular Beam Epitaxy. **UNIT- II: Synthesis methods of thin films** Film growth and measurement of thickness - Film growth – five stages - Incorporation of defects and impurities in films - Deposition parameters and grain size - structure of thin films - quartz crystal monitor photometric - Ellipsometry and interferometers - Measurement of rate of deposition using rate meter - cleaning of substrate. **UNIT- III: Characterisations of thin films** Characterization, X-ray Diffraction (XRD) - SEM, Photoluminescence (PL) - Raman Spectroscopy, UV-Vis-IR	**UNIT-I:** Different synthesis methods of thin films**(Added)** **UNIT-II:** Thermodynamics and Kinetics of thin film formation, Microbalance technique. **(Removed)** **UNIT-III:** Differential scanning spectrometry (DSC), Fourier transform spectroscopy (FTIR),	20%	Based on the feedback received from the faculty and scholars

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	Spectrophotometer – AFM - Hall effect – SIMS - X-ray Photoemission Spectroscopy (XPS) - Vibrational Sample Magnetometers, Rutherford Back Scattering (RBS). **UNIT- IV: Properties of the thin films** Properties of thin films Dielectric properties - Experimental techniques for dielectric film - annealing effect, effect of film thickness on dielectric properties – determination of optical constants – Experimental techniques for determination of optical parameters - Magnetic and mechanical properties - Hall effect compilations - Adhesion, stress, strength, Raleigh surface waves - Ferromagnetic properties of Thin films - Experimental methods for measurement of mechanical properties of thin films. **UNIT- V: Applications of thin films** Applications, Micro and optoelectronic devices, quantum dots, Data storage, corrosion and wear coatings - Polymer films, MEMS, optical applications - Applications in electronics – electric contacts, connections and resistors, capacitors and inductances - Applications of ferromagnetic and super conducting films - active electronic elements, micro acoustic elements using surface waves - integrated circuits - thin films in optoelectronics and integrated optics.		Spectrophotometer – AFM - Hall effect – SIMS - X-ray Photoemission Spectroscopy (XPS) - Vibrational Sample Magnetometers, Rutherford Back Scattering (RBS). Differential scanning spectrometry (DSC), Fourier transform spectroscopy (FTIR), Conductivity testing, Discharge characterization, LSV, CVV. **UNIT- IV: Properties of the thin films** Properties of thin films Dielectric properties - Experimental techniques for dielectric film - annealing effect, effect of film thickness on dielectric properties – determination of optical constants – Experimental techniques for determination of optical parameters - Magnetic and mechanical properties - Hall effect compilations - Adhesion, stress, strength, Raleigh surface waves - Ferromagnetic properties of thin films. **UNIT- V: Applications of thin films** Applications, Micro and optoelectronic devices, quantum dots, Data storage, Polymer films, MEMS, optical applications - Applications in electronics – electric contacts, connections and resistors, capacitors and inductances - Applications of ferromagnetic and super conducting films - integrated circuits - thin films in optoelectronics and integrated optics	Conductivity testing, Discharge characterization, LSV, CVV. **(Added)** **UNIT-IV:** Experimental methods for mechanical properties of thin films. **(Removed)** **UNIT-V:** corrosion and wear coatings, active electronic elements, micro acoustic elements using surface waves - integrated circuits**(Removed)**		

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	Textbooks: 1. K.L. Chopra, Thin film phenomena, McGraw- Hill book company New York, 1969 2. Ludminla Eckertova, 'Physics of thin films', Plenum press, New York1977.		**Textbooks:** 1. K.L. Chopra, Thin film phenomena, McGraw- Hill book company New York, 1969 2. Ludminla Eckertova, 'Physics of thin films', Plenum press, New York1977. 3. A. Goswami, Thin Film Fundamentals, New Age international (P) Ltd. Publishers, New Delhi (1996). 4. K. L. Chopra, Thin Film Phenomena, McGraw-Hill, 1969. **Reference Books:** 1. Thin-Film Deposition: Principles and Practice, McGraw-Hill, 1995. 2. Materials Science of Thin Films, Academic Press, 2nd Ed., 2002.			

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ANNEXURE – II: NEW COURSES IN THE PRE-PHD CURRICULUM FOR THE AY 2025-26

Code: 25PHY207

25PHY207 - PARTICLE PHYSICS-I

Unit – I: Elementary particle physics

Elementary particles and their interactions, Quark and leptons. Discrete symmetries, C, P, T symmetries and CPT theorem (without proof) and its consequences. Parity of charged and neutral pions, photons, leptons and quark, C-parity of neutral pion and eta, Party violation in β-decay, Measurement of Helicity of Neutrino.

Unit - II: Hadron Spectroscopy and Quark Model

Nucleon as a composite particle. Nucleon resonances and baryon spectroscopy. Isospin: SU(2), SU(3) symmetry and classification of particles and resonances. Quark model of hadrons, Properties of quarks and their classification, Color degree of freedom, Gell-Mann – Okubo mass relation, Introduction to Standard Model, Fundamentals of Quantum Chromodynamics. Quark model of hadrons, Properties of quarks and their classification, Color degree of freedom, Gell-Mann – Okubo mass relation, Introduction to Standard Model, Fundamentals of Quantum Chromodynamics.

Unit – III: Relativistic Kinematics

Review of Lorentz transformations for energy and momentum, four-vectors and invariants, Laboratory and Centre-of-momentum systems, calculation of energy, momentum and angle of particles produced in nuclear reactions in Lab. and centre-of-momentum frames and their transformations and calculation of threshold energies for particle production. Mandelstam variables, Rapidity variable and invariance of rapidity distribution in lab and CM system, Maximum and minimum rapidities, Pseudorapidity distribution in projectile, target and central fragmentation regions.

Unit - IV: High Energy Hadron-Nucleon

Features of relativistic hadron-nucleon collisions upto very high energy, behaviour of elastic, inelastic and total cross-sections as a function of incident energy, multiplicity distribution, Negative Binomial Distribution, KNO scaling and Feynman scaling.

Unit – V: High Energy Hadron-Nucleus Interactions

Two-particle correlations, short- and long-range multiplicity correlations, particle correlation and clusterization, Multiplicity fluctuations, Entropy and its generalization, Shanon and Renyi entropies, Intermittency and beyond-, erraticity, Multifractality and multifractal specific heat.

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Text Books:

1. H. Pilkuhn, The Interactions of Hadrons (First Edition), North-Holland, 1967.
2. L. P. Martin, High Energy Hadron Physics (First Edition) ,John Wiley & Sons, 1974.
3. P. D. B. Collins & A. D. Martin, Hadron Interactions (First Edition), Adam Hilger Ltd., 1984.
4. R. Hagedorn, *Relativistic Kinematics: A Guide to the Kinematic Problems of High-Energy Physics* (Reprint Edition), W. A. Benjamin, 1973.

Reference Books

1. D. H. Perkins, Introduction to High Energy Physics (Fourth Edition), Addison Wesley, 2000.
2. F. Halzen and A. Martin, *Quarks and Leptons: An Introductory Course in Modern Particle Physics* (Reprint Edition), John-Wiley, 2008.
3. C. Y. Wong, Introduction to High Energy Heavy Ion Collisions (First Edition), World Scientific, 1994.

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Code: 25PHY309

25PHY309 - PARTICLE PHYSICS-II

Unit - I: Ultra-relativistic Nucleus-Nucleus Collisions

Glauber model of nucleus-nucleus collision, participant-spectator model, Bjorken estimate of the initial energy density, hadron structure and quark confinement, hydrodynamics of Quark-Gluon Plasma and phase diagram, deconfinement phase transition, Nuclear stopping power and nuclear transparency, Space-time picture of collisions, Time history of ultra-relativistic AA collisions, Geometry of heavy ion collisions.

Unit – II: Observables & QGP signatures

Signatures of Quark-Gluon Plasma formation, dilepon production, Drell-Yan Process in nucleus-nucleus collision, direct photon production, De-bye screening in the QGP, J/ψ suppression in the QGP, strangeness enhancement, correlation and event-by-event fluctuations, Handbury-Brown-Twiss effect, transverse mass, transverse energy, an isotropic flow and jet quenching.

Unit - III: Detectors in High Energy Physics Experiments

Review of Particle Accelerations and Detectors, Linacs, Synchrotrons and colliding-beam accelerators, principle of Cerenkov counters and calorimeters. Ionization, drift and diffusion of charges in gases, pulse formation and its shape in proportional counters, Multiwire proportional counter, drift chamber, Di-Muon Spectrometer of ALICE and MuCh of CBM, Idea of radiation length and critical energy, electromagnetic shower and hadronic shower detectors, Physics scenarios at RHIC and LHC energies.

Unit – IV: Introduction to data analysis

Luminosity, Event rate, hits, primary vertex, tracks, secondary vertex, trigger and pileup.Concept of detector and electronic noise, Detector calibration, Acceptance and Efficiency estimation, event and physics trigger selection, analysis for physics objectives. Particle identification in high energy experiments: dE/dx, Range, TOF technique, Transition radiation.

Unit - V: Monte-Carlo Simulation and Event Generator

Input from detectors for data analysis, Pattern recognition and track reconstruction, Event reconstruction, Event generators, Detector simulation.
Introduction to monte carlo (MC) event generators: HIJING, PYTHIA, UrQMD, AMPT.

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Text Books:

1. R. N. Cahn and G. Goldhaber, The Experimental Foundations of particle physics (Second Edition), Cambridge University Press, 2009.

2. W. R. Leo, Techniques For Nuclear And Particle Physics Experiments : How to approach (Second Edition), Springer-Verlag, 1994.

3. T. Ferbel, Experimental Techniques in High Energy Nuclear and Particle physics (Second Edition), World Scientific, 1991.

4. R. C. Fernow, Introduction to Experimental particle physics (Revised Edition), Cambridge University Press, 2023.

Reference Books

1. P. Bevington and D.K. Robinson, Data Reduction and Error analysis for the physical sciences (Third Edition), McGraw-Hill Education, 2002.
2. R. Frunwirth, M. Regler, R. K. Bock and H. Grote, Data analysis Techniques for High Energy physics (Second Edition), Cambridge University Press, 2000.
3. K. Kleinknecht. Detectors for Particle Radiation (Second Edition), Cambridge University Press, 1998.
4. T. Ferbel, Experimental Techniques in High Energy Physics (First Edition), Addison-Wesley, 1987.

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Code: 25PHY208

25PHY208 - Phosphors for Lighting Applications

UNIT-I: Fundamentals of phosphors

Fundamentals of luminescence: Absorption and emission of light, electronic states and optical transition of solid crystals, Luminescence of a localized center, Impurities and luminescence in semiconductors, Transient characteristics of luminescence, Excitation energy transfer and cooperative optical phenomena, Excitation mechanism of luminescence by cathode-ray and ionizing radiation, Inorganic electroluminescence, Lanthanide level locations and its impact on phosphor performance.

UNIT-II: Properties of phosphors

Principal phosphor materials and their optical properties: Luminescence centers of ns^2-type ions, Luminescence centers of transition metal ions, Luminescence centers of rare-earth ions, Luminescence centers of complex ions, Ia-VIIb compounds, IIa-VIb compounds, IIb-VIb compounds, ZnSe and related luminescent materials, IIIb-Vb compounds, (Al,Ga,In)(P,As) alloys emitting visible luminescence, (Al,Ga,In)(P,As) alloys emitting infrared luminescence, GaN and related luminescence materials, Silicon carbide (SiC) as a luminescence material, Oxynitride phosphors.

UNIT-III: Methods of phosphor synthesis and related technology:

General technology of synthesis, Inorganic nanoparticles and nanostructures for phosphor applications, Preparation of phosphors by the sol–gel technology, Surface treatment, Coating methods, fluorescent lamps, Mercury lamps, Intensifying screens (Doctor Blade Method), Dispersive properties and adhesion strength.

UNIT-IV: Types of phosphor

Phosphors for lamps: Construction and energy conversion principle of various lamps, Classification of fluorescent lamps by chromaticity and color rendering properties, High-pressure mercury lamps, Characteristics required for lamp phosphors, Practical lamp phosphors, Phosphors for high-pressure mercury lamps, Phosphors for white light-emitting diodes.

Electroluminescence materials: Inorganic electroluminescence materials, Inorganic electroluminescence, Organic electroluminescence

Phosphors for plasma display: Plasma display panels, Discharge gases, Vacuum-ultraviolet phosphors and their characteristics, Characteristics of full-color plasma displays, Plasma displays and phosphors.

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UNIT-V: Measurements of phosphor properties

Measurements of luminescence properties of phosphors: Luminescence and excitation spectra, Reflection and absorption spectra, Transient characteristics of luminescence, Luminescence efficiency, Data processing, Measurements in the vacuum-ultraviolet region.

Measurements of powder characteristics: Particle size and its measurements, Methods for measuring particle size, Measurements of packing and flow.

Textbooks

1. Phosphors Handbook, Second Edition, William M. Yen, Shigeo Shionoya, Hajime Yamamoto, CRC Press.
2. Rare Earth Activated Phosphors, Vikas Dubey, Neha Dubey, Marta Michalska Domanska, M Jayasimhadri, Sanjay J. Dhoble, Elsevier.

Reference Book

1. Phosphors Handbook: Process, Properties and Applications, Vijay B. Pawade, Ritesh L. Kohale, Sanjay J. Dhoble, Hendrik C. Swart, Woodhead Publishing Series in Electronic and Optical Materials, Elsevier.

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Code: 25PHY209

25PHY209 – Synthesis and Characterization of Materials

UNIT-I: Physical and Chemical routes for synthesis of Materials

Introduction to Synthesis methods and types, Melt Quenching Method, High Energy Ball Milling, Solid State Reaction method, Inert gas condensation, Role of inert gases- Post oxidation process; Chemical Precipitation and co-precipitation; Metal nanocrystals by reduction, Sol-gel synthesis; Microemulsions or reverse micelles, Solvo-thermal synthesis. Different types of Sputtering processes – Pulsed laser deposition – Rapid solidification – Arc discharge method- Fabrication of Nanostructures Microfabrication using Etching-Lithography; Thermolysis routes, Microwave heating synthesis; Sono-chemical synthesis.

UNIT-II: Structural Characterization methods

Introduction to different characterization techniques, X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and EDAX analysis, Atomic Force Microscopy (AFM), Scanning Probe Microscopy (SPM). Scanning Tunnelling Microscopy (STM), Atomic Force Microscopy AFM)-Non-contact, contact- Tapping- conducting mode, Near Field Scanning Optical Microscopy; Scanning Capacitance Microscopy- Magnetic Force Microscopes (MFM), Chemical Force Microscope (CFM).

UNIT-III: Spectroscopic and Magnetic Characterization methods

Basic concepts of spectroscopy, Raman spectroscopy-operational principle and application for analysis of materials, Fourier Transform Infrared Spectroscopy (FTIR), UV-VIS-IR Spectroscopy, Photoluminescence (PL), Principle of operation and application for band gap measurement. Vibrational Sample Magnetometer (VSM).

UNIT-IV: Surface and Thermal characterization methods

X-ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy, BET Analysis, Electron Spin Resonance (ESR), Ferromagnetic Resonance (FMR), Nuclear Magnetic Resonance (NMR), Mossbauer Spectroscopy, Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC).

UNIT-V: Electrical and Electrochemical and Biomaterials Characterisation Methods

Cyclic Voltammetry (CV), Charge-discharge studies (C-D), Semiconducting Quantum Interference Device (SQUID), Electrochemical Impedance Spectroscopy (EIS), Four probe method. New Advances and challenges in biological and biomedical materials characterizations- Dynamic light scattering

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spectroscopy. Confocal Microscopes- Confocal Raman – Application in Nano-biotechnology. Fluorescence Microscope.

Text Books

1. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, 2004.
2. Elton N. Kaufmann, characterization of materials, Wiley Interscience, 2003
3. Y. Leng, Materials Characterisation: Introduction to Microscopic and Spectroscopic Methods, John Wiley & Sons (Asia), 2008.

REFERENCE BOOKS:

1. Chemistry of Nanomaterials: Synthesis, Properties and Applications - CNR Rao, H.C. mult.Achim Müller, A. K. Cheetham, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN: 9783527306862, 9783527602476, 2004.
2. Carl. C Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", William Andrew Publishing Norwich, 2006.
3. Dieter Vollath, Nanoparticles–Nanocomposites–Nanomaterials An Introduction for beginners, Wiley 2013
4. R.W. Cahn, E.M. Lifshitz, Concise Encyclopedia of Materials Characterization: Advances in Materials Sciences and Engineering, Elsevier, 2016.
5. Y. Leng, Materials Characterisation: Introduction to Microscopic and Spectroscopic Methods, John Wiley & Sons, 2013.
6. Tseung-Yuen Tseng and Hari Singh Nalwa, Handbook of Nanoceramics and their Based Nanodevices (Vol. 2), American Scientific Publishers, 2005.

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Date: 05/08/2025

CIRCULAR
DEPARTMENT ACADEMIC COMMITTEE (DAC) MEETING

In view of the 45th Academic Council Meeting (online mode) of the University, the Department of Physics is planned and scheduled to conduct the Department Academic Committee (DAC) meeting on 05/08/2025 from 11:30 AM in the Optics Lab (Offline, Room No: F202B).

Agenda:

1. To review and propose revisions to the existing Pre-PhD curriculum, including additions and deletions of topics, for the AY 2025-26.
2. To propose the inclusion of syllabi for newly introduced research papers in the Pre-PhD curriculum for the AY 2025-26.
3. Any other item with the permission of the BOS Chair.

DAC Members:

1. Dr. K. Swapna	Assoc. Professor, HoD & BOS-Chair
2. Dr. N.S.M.P. Latha Devi	Assoc. Professor
3. Dr. G. Sunita Sundari	Assoc. Professor
4. Dr. Shaik Mahamuda	Assoc. Professor & RPAC Chairman
5. Dr. K. Raghavendra Kumar	Assoc. Professor
6. Dr. M.V.V.K. Srinivas Prasad	Asst. Professor & Asst CoE
7. Dr. M. Venkateswarlu	Asst. Professor, Prof In-charge & Dy HOD
8. Dr. A.Venkateswara Rao	Asst. Professor
9. Dr. Shaik Babu	Asst. Professor
10. Dr. M. Gnana Kiran	Asst. Professor
11. Dr. S. Shanmugan	Asst. Professor
12. Dr. Hushnud	Asst. Professor

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Meeting Minutes of DAC held on 05-08-2025

The Head, Department of Physics conducted the DAC meeting on 05/08/2025 i.e., on Tuesday from 11:30 AM in the Optics Lab (Offline mode, Room No: F202B).

The DAC members were concerned and discussed the following points:

Members Present:

1. Dr. K. Swapna	Assoc. Professor, HoD & BOS-Chair
2. Dr. N.S.M.P. Latha Devi	Assoc. Professor
3. Dr. G. Sunita Sundari	Assoc. Professor
4. Dr. Shaik Mahamuda	Assoc. Professor & RPAC Chairman
5. Dr. K. Raghavendra Kumar	Assoc. Professor
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9. Dr. Shaik Babu	Asst. Professor
10. Dr. M. Gnana Kiran	Asst. Professor
11. Dr. S. Shanmugan	Asst. Professor
12. Dr. Hushnud	Asst. Professor

Dr. K. Swapna, Assoc. Prof., & Head of the Department of Physics welcomed all committee members to the DAC meeting.

Agenda Points discussed:

Agenda – 1

To review and propose revisions to the existing Pre-PhD curriculum, including additions and deletions of topics, for the AY 2025-26. (See Annexure – I)	**Approved the same in DAC and recommended to BOS for the approval**

Agenda – 2

To propose the inclusion of syllabi for newly introduced research papers in the Pre-PhD curriculum for the AY 2025-26. (See Annexure – II)	**Approved the same in DAC and recommended to BOS for the approval**

Any other item is discussed with the permission of the Chair, if any.

Based on the suggestions and recommendations provided by the DAC members, and considering the feedback received from faculty, we have proposed revisions to the existing Pre-PhD curriculum. These modifications are intended to enhance scholars' competency and deepen their understanding within their respective research domains. The revised curriculum also aims to create greater opportunities for engagement in R&D activities, particularly through collaborations with industries, organizations, and research institutes, in alignment with the guidelines issued by the Dean-R&D, Dean-MHS, and Principal-FED of KLEF. Furthermore, all DAC members have contributed valuable inputs for the proposed changes to the Pre-PhD curriculum offered by the Department of Physics for the AY 2025–26.

All members who attended the DAC meeting approved the proposal of inclusion of minor/major changes in the existing curriculum and new research papers in the Pre-PhD curriculum offered by the Department of Physics from the AY 2025-26. Hence, the same is recommended to the BOS Chairman for necessary considerations and approval.

Dr. K. Swapna
HOD
Dept of Physics

5/8/25

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