



Human Resource Development Centre & School of studies in Physics & Astrophysics Pt. Ravishankar Shukla University, Raipur Organized

Online Refresher Course in Physics

August-16- August-28, 2021

Report

Name of Course/Program:	Online Refresher Course in Physics						
Name of Contact person from HRDC:	Dr. Arvind Agrawal						
Date of Course/Program:	16.08.2021 to 28.08.2021						
Name of Course Coordinator:	Prof. Nameeta Brahme, Professor School of Studies in Physics and Astrophysics Pt. Ravishankar Shukla University, Raipur						
Theme of Course/Program:	"New trends of teaching and research in physics"						
Number of Participants:	37						
State wise number of participants:	Chhattisgarh - 11, Tamil Nadu- 11, Madhya Pradesh – 04, Bihar – 02, Maharashtra – 06, Andhra Pradesh – 02, North East Shillong – 01						
No. of Resource Persons:	35						
Name and Signature of Course Coordinator							
Professor Nameeta Brahme							

ONLINE REFRESHER COURSE IN PHYSICS (16.08.2021-28.08.2021)

Human resource development centre (HRDC), Pt. Ravishankar Shukla university Raipur has organized two weeks Refresher course in Physics held during 16.08.2021 to 28.08.2021. On the very first day during the inaugural session the honourable Vice-chancellor Prof. K L Verma in welcome address gave best wishes for organizing this course. Director, HRDC Prof. Shailendra Saraf welcomed the honourable Vice chancellor and the participants from various states of the country and wished them for their best performance during the course. The coordinator of the course Prof. Nameeta Brahme, professor, School of studies in physics and astrophysics introduced the session with the objectives and theme i.e. "New trends of teaching and research in physics". He also gave a brief on the various topics to be covered and the resource persons who will join and train the participants. The assistant professors from various central and state universities from all the corners of the country were participated in this course. Most of the participants were from Southern states like Tamil Nadu and Andhra Pradesh also from central part Chhattisgarh and Madhya Pradesh and few of them were from Maharashtra, West Bengal, Meghalaya and Bihar. During this two-week refresher course 36 lectures were delivered by 34 subject experts of different fields. Experts from various renowned academic institutes like IIT- Delhi, Mumbai, Patna, Roorkee, Kharagpur, Banaras, from NIT- Warangal and Rourkela and national level research institutes like BARC, DRDO, IICT and professors from different central and state universities as well as many Vice-chancellors were invited to train the college and university teachers. All the experts discussed the recent trends in the teaching, learning and research in the various fields of physics. All the fundamental topics as per the syllabus at UG and PG levels were covered and discussed in detail during this course which include quantum mechanics, astro- physics, electronics, condensed matter physics, statistical physics and nano science and technology. All the participants were evaluated on their performance in various parameters like micro-teaching, Seminar, project ending test and holistic response. Dr. N K Chakradhari, Dr. Kavita Thakur and Dr. D P Bisen has judged the micro-teaching, seminar and project respectively.

Detail of date wise organized program

The online Refresher course in Physics was organized from 16/08/2021 to 28/08/2021. Various programmes were conducted date wise.

Day 1 (16/08/2021)



The Program started at 10.30a.m. with the welcome address by Dr. Arvind Agrawal, Assistant director, H.R.D.C., P.R.S.U. Raipur in the august presence of Respected Chief Guest Prof. K. L. Verma, Vice Chancellor, P.R.S.U. Raipur and Prof. Shailendra Saraf, Director, H.R.D.C., P.R.S.U. Raipur. Respected V.C. Prof. K.L. Verma got acquainted with all the participants, then the course coordinator Prof. Nameeta Brahme gave detailed information regarding the 12 days Online Refresher course in physics to the participants. In the end, the respected Vice Chancellor gave brief information about the program while congratulating the Participants



Director, HRDC.



Course Coordinator

In the second session (12.15pm to 13.45pm) Dr. S K Pandey,

Former Professor, SOS in Physics and Astrophysics, P.R.S.U delivered a lecture on "A physicist view of the universe". Sir started with basic concepts on universe, galaxies and black holes. He also answered the questions of the participants on Black holes.



In the Third and Fourth session (14.15pm – 15.45pm & 16.00 pm – 17.30 pm)

Dr. Shimachala Panigrahi, Professor, Department of physics, National Institute of Technology, Rourkela delivered two talks namely "Quantum Paradox to Quantum reality I and II". His session started with the basics of wave particle duality then he discussed the failures of classical mechanics. In the second part of his talk he explained in detail the quantum computation methods, quantum entangling etc. Prof. Panigrahi resolved the questions and doubts of the participants in an efficient manner.



Day 2 (17/08/2021)

In the first session (10.30am – 12.00 noon) Dr. Giri Babu Principal Scientist, IICT, Hyderabad discussed on "Status of exitonic Solar cells". In his lecture, respected Giri Babu sir explained the current status of perovskite solar cells and their advantages over traditional solar cell. He also explained the scope of research in this field.



During the second session (12.15pm– 13.45pm) **Dr. Humchand,** Professor and Head Department of Physics and Astronomical Sciences, Central University of Himanchal Pradesh talks about "Extra galactic astronomy mainly consisting of observational cosmology ". He explained AGN probing and how evolution of universe can be explained with the help of AGN spectroscopy. At the end of his lecture, respected sir, addressed some of the queries of the participants.



In the Third session (14.15pm – 15.45pm) **Dr. Tanmaya Badapanda**, Associate Professor, Department of Physics, C V Raman Global University, Bhubaneswar discussed on the topic "Ferroelectricity and Piezoelectricity in solids" Prof. Badapanda explained in a very interesting manner from the initial concepts of ferroelectricity and piezoelectricity in solids using thermodynamical relations and graphs. He also introduced the participants with his current research on the ferroelectric materials.

In the fourth session (16.00pm – 17.30pm), **Dr. Lakshman Pandey** Professor, Department of Physics and electronics, Rani Durgawati Vishwavidyalaya, Jabalpur, MP discussed on the topic "Basics of Impedance Spectroscopy". He introduced the participants with the indigenous probe developed by him in 1992 to measure the impedance of the ceramic samples. He also explained the fundamental concepts of impedance spectroscopy and analysis of impedance data.



Day 3: (18/08/2021)

In first session (10.30am - 12.00 noon) Dr. S K Omanwar, Former Professor and UGC-BSR faculty fellow, Department of Physics, Sant Gadge Baba Amravati University, Amravati delivered his speech on "SPV challenges in 21st century". In the beginning of his talk he gave a brief about the requirement of solar energy for industrial and social applications. During the speech, he discussed about the solar photovoltaic cells, the materials used, their commercial needs and power generation from SPV and its efficiency. His presentation was very nice and informative with updated data.



In the second session (12.15pm - 13.45pm) Dr. R C Agarwal, Former Professor, SOS in Physics and Astrophysics, P.R.S.U, delivered his talk on "Solid state ionic conductors exotic energy materials: synthesis and materials characterization techniques. He explained the use of Alkali halides as ionic conductors and the recent trends in this field. He presented the talk in a very interesting manner to the participants and also cleared their various doubts as well.

In the Third session (14.15pm – 15.45pm) Dr. Ajit Kulkarni, Professor, Department of Metallugy and Materials Engineering, Indian institute of Technology Bombay, Mumbai, Maharastra delivered an interesting and useful talk on the topic "Piezoelectric ceramics: Concerns, solutions and Multifunctional applications". In beginning sir gave some fundamental concepts on piezoelectricity like direct and indirect piezoelectric effect and the various parameters related to these effects. He graphically explained the macroscopic material behaviour, the hysteresis plots, the butterfly plots for strain measurements etc. he also gave a view on the choice of materials for industrial applications for the development of sensors, actuators etc. He also discussed the recent findings on piezoelectric materials done by his research group.

In the fourth session (16:00pm – 17:30pm) under the guidance of **Prof. N K Chakradhari**, SOS in Physics and Astrophysics, P.R.S.U., Raipur, 12 participants gave their microteaching on various topics related to module one after another. After this Dr. **Chakradhari**, made a brief analysis of the teaching methods and skills of the participants.

Day 4: (19/08/2021)

In the first session (10.30am – 12.00 noon) **Prof. P K Bhatnagar** of Department of Electronic Science, University of Delhi, South Campus, New Delhi, delivered his speech on "Recent trends in Organic LEDs". He explained the about the various types of Organic LEDs and the fundaments physics of these OLEDs. He also aware the participants with white LEDs. He answered all the questions raised by the participants patiently.



In the second session (12.15 pm– 13.45 pm) **Dr. Manoranjan Kar Associate Professor,** Indian Institute of Technology, Patna, deliberated the talk on "Physics of Magnetic Composites derived from soft and hard magnetic materials". Respected Dr. Kar Started his talk with fundamental concepts of classical and quantum mechanics then he moved on to the crystalline structures, super structures and quasi crystals. Then he discussed the hard and soft magnetic materials. After that he explained the composite materials and nanocomposites and their synthesis. He also answered the questions of the participants in a lucid manner.



In last two consecutive sessions (14.15pm - 15.45pm and 16.00pm - 17.30pm) under the guidance of Prof. N K Chakradhari, SOS in Physics and Astrophysics, P.R.S.U., Raipur, remaining 25 participants gave their microteaching on various topics related to module one after another.

Day 5: (20/08/2021)

In first session (10.30 am - 12.00 noon) **Prof. R K Pandey**, Vice- Chancellor, Amity University, Raipur, explained about "World of Solid Materials: tailoring for future". In this talk, Dr. Pandey very concisely explained the Drude theory and Sommerfeld's model. He then differentiated the Bulk and nano materials. He also explained the 1D, 2D, 3D nano structures. Interacting with the participants he also talked about the Tight Binding Approximation. He also motivated the participants to work towards the all-round development of their students as well as enhancingtheir skills and critical thinking.



In the second session (12.15pm - 13.45pm) **Prof. U P Verma**, School of Physics, Jiwaji University, Gwalior, MP delivered a talk on "Numerical methods in Physics". In this session Prof. Verma mentioned various numerical and computational methods for non-linear and linear equations. He also showed some programs that elaborated the quantum states of electron at various energy values.



In the Third session (14.15pm –15.45pm) **Dr. H S Tiwari**, Professor, Department of Pure and Applied Physics, Guru Ghasidas Central University, Bilaspur (CG), delivered a talk on "Introduction of Perovskite oxides- based ceramics: Synthesis and applications".



In the fourth session (16.00pm – 17.30pm) **Dr. R Harnath, Associate** Professor, National Institute of Technology, Warangal, Telangana elaborately discussed on the topic "Invisible fingerprint detection using afterglow phosphors for forensic applications". Here he raised various issues related to the culprits and the different types and patterns of finger prints. He also made the participants about the new software developed to identify the finger prints.



Day 6: (21/08/2021)

In the first session (10.30 am– 12.00 noon) **Dr. Ravi Sharma**, Assistant Professor, Department of Physics, Govt. Girls' College Devendra Nagar, Raipur, in his speech elaborately discussed on the topic "Nano Materials: New age materials".

In the second session (12.15pm - 13.45pm) **Dr. Manoj Mohapatra**, radiochemistry division BARC, Trombay, Mumbai, delivered a talk on "A brief look at molecular spectroscopy: from Luminescence to magnetic resonance".



In the Third session (14.15pm –15.45pm) **Dr. Omprakash Thakur,** Scientist F, Physics Lab, DRDO Timarpur, Delhi, delivered talk on "Functional ceramics for strategic applications".

In the fourth session (16.00pm – 17.30pm) **Dr. R N Baghel, Former** Professor, SOS in Physics and Astro-Physics, PRSU, Raipur elaborately discussed on the topic "Basics of Microprocessor".



Day 7: (23/08/2021)



In the first session (10:30am- 12:00 noon) **Prof. B N Jagtap, Professor, Indian Institute of Technology, Mumbai,** delivered lecture on "Teaching Science and NEP-2020". While discussing in detail on NEP 2020, giving complete information regarding 5+3+3+4, he also told its importance for the complete development of the students. Now we have multidisciplinary approach, in which students can do their studies by choosing different subjects and institutions as per their convenience.



The second session (12.15pm – 13.45 pm) was taken by **Dr. K V R Murthy**, **Professor**, **Faculty of Technology**, **M. S. University**, **Vadodara**, delivered lecture on "Organic Light Emitting Diodes". He discussed about the various aspects about LEDs.

In the third sessions (14.15 pm - 15.45 pm) **Dr. Balak Das**, **Professor, Department of Physics, Lucknow University, UP** delivered lecture on "Powder X-ray Diffraction". He explained the physics of X-ray diffraction and discussed powder diffraction method in detail. He also the answered the queries raised by the participants patiently.



In the fourth session (16.15pm - 17.30pm) under the chairmanship of **Prof. Kavita Thakur** SOS Electronics, Pt. Ravishankar Shukla University, Raipur, we had seminar as per the module. 12 participants presented their seminar one by one, which was evaluated by Prof. Thakur. After the seminar he had given some suggestions to develop the skill of presenting seminar paper. At the end of the session chairperson was given thanks for evaluating the seminar presented by the participants.

Day 08: (24/08/2021)

In first session (10.30 am - 12.00 noon) Prof. M R Shenoy, Professor, Department of Physics, Indian Institute of technology, Delhi given lecture on "Optoelectronic Devices". In his lecture, Dr. Shenoy gave information about semiconducting opto electronic materials including direct and indirect semiconductors, III-V group compounds etc.



In the second session (12.15pm - 13.45pm) **Dr. S K Rout,** Professor, Department of Physics, Birla Institute of technology, Mesra given lecture on "Role of materials research for social development". He discussed the nano-materials and related research.

In third & fourth sessions (14.15pm - 13.45pm and 16.15pm - 17.30pm) under the chairmanship of **Prof. Kavita Thakur** SOS Electronics, Pt. Ravishankar Shukla University, Raipur, we had seminar as per the module. 25 participants presented their seminar one by one, which was evaluated by Prof. Thakur.



Day 9: (25/08/2021)

In the first session (10.30am – 12.00 noon) Prof. S A Hashmi, Professor, Department of Physics and Astro Physics, University of Delhi (North campus), new Delhi delivered his speech on "Carbon Supercapacitors as power sources: fundamentals and recent advances".

In the second session (12.15 - 13.45), Dr. Dinakar, Professor, National Institute of Technology, Warangal, Telangana elaborately discussed on the topic "Optical fibers and their applications". He made his talk very interesting by the videos shown during the talk. He also addressed various issues related to optical fibers.



The third session (14.15pm - 13.45pm) was taken by Dr. Pankaj Shrivastava, Professor & Head, Dept. of Physics, IIITM, Gwalior (MP) delivered talk on "Crystallography and Crystal Structure". He gave the concept of fundamentals of solid-state physics.



The fourth session (16.15 pm- 17.30pm) was the session for the projects to be presented by the participants. For this a group of four participants was formed by the course-coordinator. A total of 10 groups were created. Under the chairmanship of Prof. D P Bisen, Professor and Head, SOS in Physics and Astrophysics PRSU, Raipur CG the projects were presented by the groups. All the groups presented the project one by one.After each presentation Dr. Bisen suggested some necessary corrections to improve the quality of a research proposal. At the end of the session, chairperson was given thanks for evaluating the projects presented by the participants.

Day 10: (26/08/2021)

In the first session (10.30am - 12.00pm), **Prof. Dilip Kumar Chowdhary**, Department of Physics, D B Science College Gondia, delivered lecture on the topic "Converting your PC into a science laboratory using expEYES junior". He elaborated the topic starting with real world situation of knowledge and skills. This session was practical session where he experimentally shown the application of expEYES for conducting many experiments at UG and PG levels.



In the second (12.15pm - 13.45pm) **Dr. Parth Roy Chowdhari**, Professor, Department of Physics, Indian Institute of Technology, Kharagpur excellently presented her lectures on "Fibre optic components and sensors: Designing principle to demonstration through lab experiments". The session was very interesting and fruitful.



In the third sessions (14:15pm – 15:45pm) **Dr. Vipul Rastogi**, Professor, Department of Physics, Indian Institute of Technology, Roorkee, presented her lecture on "Fundamentals of Photonics". Sir started his talk with the basics of LASERs, he discussed the self and stimulated emissions. He also elaborated the terms like optical pumping, laser action, population inversion etc. He also cleared the doubts of the participants. Thesession was very interesting and interactive.



The fourth session (16.15 pm- 17.30pm) was the session for the projects, to be presented by the participants. Under the chairmanship of Prof. D P Bisen, Professor and Head, SOS in Physics and Astro Physics, PRSU, Raipur CG the projects were presented by the groups. All the groups presented the project one by one, which were evaluated by Prof. Bisen. After each presentation he suggested some necessary corrections to improve the quality of a research proposal. At the end of the session, chairperson was given thanks for evaluating the projects presented by the participants.



Day 11: (27/08/2021)

The first session (10.30 am- 12.00 noon) was taken by **Dr. Sourabh Tripathi**, Department of Physics, Indian Institute of Technology, Banaras Hindu University. He delivered the talk on "Unambiguous evidence of three coexisting ferroelectric phases in a lead-free LiNaNbO3 system". He answered the queries of the participants, some the participants also discussed their current research and related issues and Prof. Tripathi satisfied the queries in very interactive manner.



In the session session (12.15pm - 13.45pm), **Prof. Dilip Kumar Chowdhary**, Department of Physics, D B Science College Gondia, delivered lecture on the topic "Development of Quantum Mechanics". Prof. Chowdhary started his talk with the Failures of Classical mechanics, Black Body radiation then he discussed the wave particle duality and Compton effect. The session was very interactive the expert and the participants discussed the related topics in a very fruitful manner.



The third & fourth consecutive sessions (14.15 - 15.45 and 16.00 - 17.30) were Chaired by Prof D P Bisen were he judged the projects presented by the remaining groups. In the end the participants thanked prof. Bisen for his valuable suggestions to improve their research caliber.

Day 12: (28/08/2021)



In first session (10.30am - 12.00 noon) Prof. Anshuman Dalvi, Professor, department of Physics, BITS Pilani, Rajasthan delivered talk on "High energy batteries and supercapacitors: recent trends in future". In this talk he started fundamentally with discussion on batteries, capacitors and supercapacitors. He also discussed the generations of batteries and advancement in the field providing suitable examples. In the last segment of his presentation, he discussed the work done by his research group.

In second & third consecutive sessions (12:15pm- 13:45pm and14.15pm - 15.45pm) the talks were delivered byDr. Y M Gupta, Principal, Rungta College of Engineering, Raipur (CG). He delivered talks on "Basics of Statistical Physics I & II". He started with the basic concepts of system, surroundings, ensembles, micro and macro-states etc. he also explained basic theories involved in the statistical physics. In the end thanking all the participants and wishing everyone a bright future.

VALEDICTORY FUNCTION

The Valedictory function was started at 5 pm in the esteemed presence of honourable vicechancellor Prof. K L Verma, Director Prof. Shailendra Saraf and Course co-ordinator Prof. Nameeta Brahme. In the valedictory session the honourable vice-chancellor Prof. K L Verma, blessed the session and wished the organisers for successful completion of the course. Director Prof. Saraf wished all the participants foe their excellent academic career. Three participants Dr. M Dhanshankar from Govt. Arts & Science College Sivakashi, Tamil Nadu, Dr. Ch Atchyuth Rao, Baptla College of Arts & Science, Baptla, Andhra Pradesh, Mr. Alwin Nongbri from Lady Kean College, Shilong Meghalaya gave feedback on the entire course. The final report was presented by the co-ordinator Dr. Nameeta Brahme. Dr. Arvind Agarwal, Assistant Director, HRDC gave the vote of Thanks. Then all had a group photo.





UGC - HRDC, PRSU, Raipur, Chhattisgarh Tentative Time Table: Online Refresher Course in Physics Course Coordinator: Prof. Nameeta Brahme

	Servion I		Session II		Session III		Session IV
	(10:30 to 12:00)		(12:15 to 12:45)		(14-15 to 15-45)		(16:00 to 17:30)
	(10.50 to 12.00)		First Wools		(14.15 (0 15.45)		(10.00 10 17.50)
Day 01		т	Lecture 1	T	Lootuno 1	т	T
Day 01 16.08.2021	Registration, Inauguration & Induction	T E A B R E A K	Lecture 1 Dr. S.K. Pandey (Ex-VC) Former Professor SoS in Physics and Astrophysics Pt. R. S. University, Raipur proskp@gmail.com Title: A physicist view of the universe	L U N C H B R E A K	Lecture 2 Dr. Shimachala Panigrahi Professor Dept. of Physics NIT Raurkela spanigrahi@nitrkl.ac.in Title: Quantum paradox to quantum reality-I	T E A E A K	Lecture 3 Dr. Shimachala Panigrahi Professor Dept. of Physics NIT Raurkela spanigrahi@nitrk1.ac.in Title: Quantum paradox to quantum reality-I
Day 02	Lecture 4		Lecture 5		Lecture 6		Lecture 7
17.08.2021	Dr. Giri Babu Principal Scientist IICT, Hyderabad Title: Status of Excitonic Solar Cells		Dr Humchand Professor & Head Department of Physics and Astronomocal Sciences, Central University of Himachal Pradesh, Himachal Pradesh <u>humchand@gmail.com</u> Title: Extra galactic astronomy mainly consisting of observational cosmology		Dr. Tanmay Badapanda Associate Professor Dept. of Physics CV Raman Global University, Bhubaneswar badapanda.tanmaya@gmail.c om Title: Ferroelectricity and piezoelectricity in solids		Dr. Laksman Pandey Dept. of Physics and Electronics, R.D.V.V Jabalpur, (M. P.) pandey@hotmail.com Title: Basics of Impedance Spectroscopy
Day 03 18.08.2021	Lecture 8 Dr. S.K. Omanwar Former Professor (HAG) & UGC-BSR Faculty Fellow Department of Physics Sant Gadge Baba Amravati University, Amravati <u>omanwar@rediffmail.com</u> Title: SPV Challenges in 21st Century		Lecture 9 Dr. R.C. Agarwal Former Professor SoS in Physics and Astrophysics rakesh c agrawal@yahoo.co.in Title: Solid state Ionics conductor's exotic energy materials synthesis and material characterization studies		Lecture 10 Dr. Ajit Kulkarni Professor Dept. of Metallurgy & Materials Engineering IIT Bombay, Mumbai (M.S.) ajit2957@gmail.com Title: Piezoelectric Ceramics: Concerns, Solutions and Multifunctional Applications		Micro- teaching

	Session - I		Session - II		Session - III	Session - IV
	(10:30 to 12:00)		(12:15 to 13:45)		(14:15 to 15:45)	(16:00 to 17:30)
D 04		-	First Week			
Day 04 19.08.2021 Day 05 20.08.2021	Lecture 11 Prof. P. K. Bhatnagar Dept. of Electronic Science University of Delhi South Campus, New Delhi promod48@rediffmail.com Title: Organic electronics and its applications Lecture 13 Prof. R. K. Pandey Vice Chancellor, Amity University, Raipur prof.rkpandey@gmail.com Title: World of Solid Materials: Tailoring for Future	T E A B R E A K	First Week Lecture 12 Dr. M. Kar Associate Professor, IIT, Patna mano@iitp.ac.in manoiitg@gmail.com Title: Physics of Magnetic Composites Derived from soft and hard Magnetic Materials <u>AH~M plot</u> Lecture 14 Prof. U. P. Verma School of Physics, Jiwaji University, Gwalior, MP upv.udai@gmail.com Title: Numerical methods in	L U N C H B R E A K	Micro-teaching Lecture 15 Dr. H. S. Tiwari Professor, Department of Physics Guru Ghasidas Central University, Bilaspur tewari.hs@gmail.com	Micro- teaching Micro- teaching Lecture 16 Dr. R. Haranath Associate Professor Physics NIT Warangal, Telangana haranathnitw@gmail.com Title: Invisible fingerprint
	9		physics		Title: Introduction to Perovskite Oxides based Ceramics: Synthesis and applications	detection using afterglow phosphors for forensic applications
Day 06 21.08.2021	Lecture 17		Lecture 18		Lecture 19	Lecture 20
	Dr. Ravi Sharma Asst. Prof. Dept. of Physics Devendra Nagar College Raipur rvsharma65@gmail.com Title: Nanomaterials: New Age		Dr. Manoj Mohpatra Radiochemistry Division BARC, Trombay, Mumbai <u>manojm@barc.gov.in</u> Title: A brief look at molecular spectroscopy: from luminescence to magnetic resonance		Dr. Omprakash Thakur Scientist F Physics Lab, DRDO Timarpur, Delhi omprakasht@hotmail.com Title: Functional ceramics for strategic applications	Prof. R. N. Baghel. Former Professor SoS in Phys and Astrophysics Pt. R. S. University, Raipur Title: Basics of Microprocessor

	Session - I		Session - II		Session - III		Session - IV
	(10:30 to 12:00)		(12:15 to 13:45)		(14:15 to 15:45)		(16:00 to 17:30)
-		_	Second Week	-		T _	
Day 07 23.08.2021	Lecture 21	T E	Lecture 22	L U N	Lecture 23	T E	
	Prof. B. N. Jagtap Professor	А	Dr. K. V. R. Murthy Professor	C N	Prof. Balak Das	A	Seminar
	IIT Mumbai	B	Faculty of Technology, M.S.	H	Department of Physics		
	bnjagatap@gmail.com	R	University, Vadodara	_	Lucknow University, Up	R	
		E	drmurthykvr@yahoo.com	B	bdas226010(@gmail.com	E	
	Title: Teaching science and	A		E		A	
	NEP 2020	Κ		A	Title: Dowdon V you	K	
			Title: Organic Light emitting	Κ	Differentian		
			Diodes		Diffaction		
Day 08 24.08.2021	Lecture 24		Lecture 25				
	Dr. M. R. Shenoy		Dr. S. K. Rout		Seminar		Seminar
	Professor,		Professor				
	Physics department,		Department of Physics				
	IIT Delhi		Birla Institute of Technology,				
	mrshenoy@physics.iitd.ac.in		Mesra				
			kanchi-835 215, Jharkhand, skrout@bitmesra.ac.in				
	Title: Optoelectronic devices		Title: Role of materials research for social development				
Day 09 25.08.2021	Lecture 26		Lecture 27		Lecture 28		
	Prof. S. A Hashmi		Dr. Dinakar		Dr. Pankaj Shrivastava		Project Presentation
	Dept. of Physics and		Professor, Dept. of Physics,		Professor & Head		
	Astrophysics, University of		NIT Warangal		IIITM, Gwalior (M.P.)		
	Delhi (North Campus)		dinakar@nitw.ac.in		pankajgw143@gmail.com		
	New Delhi				1		
	sahashmi@physics.du.ac.in		Title: Optical fibers and their		Title: Crystallography and		
	Title: Carbon Supercapacitors		applications		Canatal starstore		
	as Power Sources:				Crystal structure		
	Fundamentals and Recent						
	Advances						

	Session - I		Session - II		Session - III		Session - IV	
	(10:30 to 12:00)		(12:15 to 13:45)		(14:15 to 15:45)		(16:00 to 17:30)	
Second Week								
Day 10 26.08.2021	Lecture 29 Prof. Dilip Kumar Chowdhary Department of Physics, D.B. Science college, Gondia, M.H. dschoudhary@dbscience.org Title: 'Converting your PC into a Science Laboratory	T E A B R E A K	Lecture 30 Prof. Partha Roy Chowdhuri Professor, Physics department, IIT Kharagpur, W.B. Mobile no.: 9433522600 Title: Fibre optic Components and Sensors: Designing Principle to	L U N C H B R E A K	Lecture 31 Dr Vipul Rastogi Professor, Physics department IIT Roorkee vipul.rastogi@ph.iitr.ac.in Title: Fundamentals of Photonics	T E A B R E A K	Project Presentation	
	using expEYES Junior."		Demonstration through Lab Experiments "					
Day 11 27.08.2021	Lecture 32		Lecture 33					
	Dr. Saurabh Tripathi Assistant Professor Dept. of Physics IIT BHU stripathi.phy@itbhu.ac.in Title: Unambiguous evidence of three coexisting ferroelectric phases in a lead-free Li ⁺ _x Na _{1-x} NbO ₃ system		Prof. Dilip Kumar Chowdhary Department of Physics, D.B. Science college, Gondia, M.H. dschoudhary@dbscience.org Title: Development of Quantum Mechanics		Project Presentation		Project Presentation	
Day 12 28.08.2021	Lecture 34 Prof. Anshuman Dalvi BITS Pilani, Rajasthan anshumandalvi@gmail.com Title: High energy batteries and supercapacitors: recent trends in future		Lecture 35 Dr. Y. M. Gupta Principal Rungta college of Engineering ymg@rungta.ac.in Title: Basics of Statistical Physics I		Lecture 36 Dr. Y. M. Gupta Principal Rungta college of Engineering ymg@rungta.ac.in Title: Basics of Statistical Physics II		Ending Test (4.00pm to 4.45pm) & Valedictory	

Some abstracts of the talks are given below

A PHYSICIST'S VIEW OF THE UNIVERSE

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Summary

Universe, by definition, includes everything, literally, as there can't be anything outside its domain. From the early days of human civilization mankind has looked at the sky with awe and wonder, and has made sincere attempts to understand the celestial phenomenon. This comes under the discipline of science known as Astronomy, and is indeed the oldest of all natural sciences. There exist old records of observations with unaided eyes of nearby objects such the Moon, Planets, comets, the Sun, bright stars etc., but modern astronomy indeed began when Galileo pointed his 20x telescope towards the sky and made observations of the moon, planets and the Sun, and since then human race has not looked back in deciphering the mysteries of the beautiful universe we live in! This has been made possible by building bigger and bigger telescopes covering the entire electromagnetic spectrum, space telescopes on one hand and sophisticated backend instrumentations for recording the data on the other. Development of computer technology along with the software for the reduction and analysis of the huge amount of observational data collected from the telescopes has empowered the scientist for scientific exploration of the cosmos. In the process, we have known the vastness of the Universe. The human race as it exists on the planet Earth is perhaps the last in the sequence of evolutionary history of the Universe, but, undoubtedly, is the most intelligent form of life endowed with ability to observe, query and reason about the nature, and thus shares the responsibility of understanding the Universe in process of finding its place in the vastness of the Cosmos.

If one reads and critically analyze the historical developments in science one finds that ultimately all the developments in science is aimed at delivering the best for the human race, sooner or later.

Astronomy, is truly referred to as the mother of all sciences which in turn implies that the understanding of the structure and dynamical evolution of the Universe at large needs inputs from all branches of existing knowledge in general, and science including Physics, in particular. In other words, the Universe is viewed from the point of view of Physicists, Chemists, Biologists and like, in order finally to build an integrated or a holistic picture of the Universe. Here, I plan to describe our understanding of the Universe from the point of view of a Physicist i.e. understanding cosmic events using known laws/theories/principles of Physics as are known on our planet Earth.

SOLID STATE IONIC CONDUCTORS: EXOTIC ENERGY MATERIALS SYNTHESIS AND MATERIAL CHARACTERISATION STUDIES

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Abstract

Solid State Ionic materials, referred to as 'Superionic Solids' / 'Fast Ion Conductors' /'Solid Electrolytes', are exotic energy materials having tremendous technological relevance in the development of variety of electrical power sources. These systems are pure ion conductors, exhibiting room temperature conductivity close in the range that of liquid/aqueous electrolytes. Hence, they can be used as potential alternate to liquid / aqueous electrolytes to develop wide variety of All-Solid-State electrochemical devices viz. batteries, fuel cells, supercapacitors, ECDs etc. The field of Solid State Ionics, relatively a new branch in Materials Science Research, emerged in the year 1967 after the discovery of two groups of solids viz. MAg₄I₅ (where M = Rb, K, NH₄) and Na- β -alumina exhibiting exceptional high Ag⁺/ Na⁺ conduction $(\sim 10^{-1} \text{ Scm}^{-1})$ at room / moderately-high temperature respectively. Since then in the last nearly 5-decades, large number of fast ion conductors, involving variety of mobile ion species viz. H⁺, Ag⁺, Cu⁺, Li⁺, Na⁺, K⁺, Mg²⁺, O²⁻, F⁻ etc, have been discovered and their applicability in above mentioned electrochemical devices have been explored. On the basis of microstructure / physical characteristics / synthesis routes, Solid State Ionic materials have been grouped into four broad category of electrolyte phases viz. crystalline/poly-crystalline, glassy/amorphous, composite and polymeric.

In the present talk, a generalized overview on different solid electrolyte phases as well as material designing will be made. Some common techniques widely used to characterize the materials / ion transport properties will be briefly discussed. The phase identification and material characterizations are usually done using XRD/ SEM/ FTIR/ DSC/DTA/TGA techniques, while the ion transport property is characterized in terms of ionic conductivity (σ), ionic mobility (μ), mobile ion concentration (n) and ionic transference number i.e. total (t_{ion}) and cation (t_+) transport numbers. These ionic parameters are evaluated experimentally employing different ac/dc techniques. The temperature dependent measurements on these ionic parameters are also done in order to understand the ion transport mechanism.

Topic: Ferroelectricity and piezoelectricity in solids

Dr. Tanmaya Badapanda Associate Professor Dept. of Physics CV Raman College of Engineering, Bhubaneswar badapanda.tanmaya@gmail.com Ferroelectricity and piezoelectricity is the most fascinating properties of dielectric solids. Materials exhibiting ferroelectric properties must be either single crystals or polycrystalline solids composed of crystallites; they must also possess reversible spontaneous polarization. Piezoelectricity is the phenomenon of development of an electric charge on the surface of crystalline insulators in response to an applied mechanical stimulus. Piezoelectric and ferroelectric materials are widely used in many areas of technology and science. In the lecture, We shall discuss the various features of ferroelectrics and peizoelectrics, the mechanisms responsible for the appearance of these features, and ferroelectric materials and their applications. It will also highlight some experimental results related to result work.

Teaching Science and NEP2020

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National Education Policy 2020 (NEP2020) makes a strong pitch for quality education, skill development, employability, entrepreneurship and socially relevant research. It further lays stress on developing critical thinking among students and achieving better teaching–learning outcomes. In order to realize these objectives, science teachers need to re-think of the current teaching practices. In this presentation, we discuss a general framework for teaching science subjects in class rooms. The talk will also cover some important issues which teachers must take into account in the online teaching mode.

Piezoelectric Ceramics: Concerns, Solutions and Multifunctional Applications

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The macroscopic behavior of ferroic functional materials such as ferroelectrics that combine dielectric, pyroelectric and piezoelectric characteristics are discussed in Solid State Physics at graduate level. However, the applications in commercial domains as vibration energy harvester/micro-power generator (MPG), resonator/filter, actuators, transducers, FRAM, hightemperature multilayer capacitors in automotive and aerospace related industrial applications and as hydrophones for underwater signals are found in materials that are made in certain crystal structures. To date, PZT is one of the most widely studied and exploited piezoelectric material, and has found a permanent place in the field of Materials Science and Engineering. Most importantly it has an estimated market of tens of billions of dollars for both strategic and commercial applications. However, lead oxide, which is a major component in PZT, is highly toxic and its toxicity is further enhanced during processing at high temperature causing environmental pollution. For a safer environment and human life the solution is minimizing or eliminating lead appears to be only option. Consequently, there has been growing interest in developing alternative lead-free ferroelectric and piezoelectric materials There had been many attempts by researchers in the past to develop alternative lead-free materials but none of them seems to satisfy the entire criterion required as alternatives to PZT's. Till recently, no suitable successors have been found. Candidates are typically too feeble in their piezoelectric effect and/or physical durability.

As materials scientists, we have identified the fundamental macroscopic aspects that predominantly allow design of materials, lead free, that would allow enhancing the piezoelectric properties and bring them closer to that of PZT for a few specific applications where the two materials can be exchanged with entailing any change in the design of the gadgets. In our group, at IIT Bombay, we have developed lead-free piezoceramics, in the Na_{0.5}Bi_{0.5}TiO₃(NBT)-based MPB systems with enhanced electromechanical properties (k_P, d₃₃, g₃₃, Q₃₃) that are technologically important for advanced applications in actuator, energy harvesting, energy storage, refrigeration etc. Our work on bulk ceramics has been extended to thin film growth using PLD and fabrication of Magnetoelectric devices. We discuss two case studies, where these composites of Piezoelectric and magnetic materials without lead greatly improved properties. The challenges and opportunities to establish potential for commercial usage of NKBT, for both, bulk and thin film actuators and sensors will also be presented.

PHYSICS OF MAGNETIC COMPOSITES DERIVED FROM SOFT AND HARD MAGNETIC MATERIALS: ΔH~M plot

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ABSTRACT

Composite materials exhibit very interesting properties which have brought attention to researchers and technologists. Not only it exhibits very rich physics but also promise for technological applications. Magnetic composites are one of them to gain somewhat more attention in recent years due to their applications in recording media and refrigeration. Also, they show multiferroic property along with magnetoelectric property which is the hot research topic among the researchers. Therefore, researchers are focused intensively on the synthesis and characterization of different types of magnetic composite materials. The main advantage of magnetic composite materials lies in their tunability of the various magnetic parameters (magnetization, remanent polarization, coercivity field, and loop area) depending upon the applications. However, the variation in magnetic parameters of the composite greatly influences by the presence of magnetic interaction at the interface. Therefore, some of the important composites materials are described here to understand the origin of magnetic properties. The multiferroic materials includes $(1-x)Bi_{0.85}La_{0.15}FeO_3-(x)CoFe_2O_4,$ $(1-x)BiFe_{0.80}Ti_{0.20}O_3-$ (x)Co_{0.5}Ni_{0.5}Fe₂O₄ exhibit the enhanced magnetization which is correlated with the lattice strain induced surface interaction. Besides, Vegard's law has been used to estimate the theoretical value of magnetization for composites and compared with the experimental value.

Similarly, the nanocomposite of (1-x) Bi_{0.85}La_{0.15}FeO₃-(x) BaFe₁₂O₁₉ was prepared by the solidstate method and high energy ball milled method to observe the existence of magnetic interaction (exchange bias) and correlated with the magneto-crystalline anisotropy and magnetic width. In addition, the modification of magnetic ordering due to surface interaction in BHF-BaTiO₃ nanocomposite has been studied. The BHF is a well-known hard permanent ferrimagnet, which generally uses in the magnetic recording device industries. Another side, BTO (Barium Titanate oxide) is a very good ferroelectric material and but, exhibits weak ferromagnetism for the crystallite size of < 60 nm. Therefore, to BTO-BHF nanocomposite exhibits magnetic interaction by the surface modification at the interface which is directly influenced the overall magnetic parameters. Similarly, the antiferromagnetic (NiO) and ferrimagnetic (CFO) based composite shows the magnetic interaction due to the change in the magnetic anisotropy at the interface. Overall, nanocomposites have immense opportunities in the field of various applications by tuning the magnetic properties.

Mostly, the interaction between two magnetic materials in the magnetic composites can be understood by the forced curve. However, recently, our research group has been proposed a simple method by considering the Δ H~M plot.

The World of Solid Materials: Tailoring for Future Rajendra Kumar Pandey Amity University, Chhaattisgarh

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ABSTRACT

We live in a "Material World" has been used by all the seers in a philosophical sense. But as we look around and see the vast variety of materials available, we realize that most of them are new. In fact, more varieties of materials were made in the last one hundred years than the ones made in all the remaining centuries of our existence. New materials, or ways to make materials, are gaining greater use because of their improved properties. These properties result from the materials' composition and structure at all scales, down to their atomic or molecular structure and arrangement.

This lecture will begin with the basics of solid-state physics and how changing structure, chemical composition and size affects their properties. Applications of novel materials in the new and futuristic areas in science technology shall also be discussed,