

## **Research Program of Department of Physics and Materials Science and Engineering**

### **1. Advanced Materials and Devices**

In recent years, discovery of new materials has improved human life through large number of useful technologies based on the functional properties of these materials. Be it industry or research organizations, development of new and better performing materials has taken centre stage of activity worldwide. With emergence of new tools and technologies, understanding of materials and capability of tailoring their properties to make them more functional and useful have tremendously increased. The capability of manipulation of materials and their properties is the key for making things with superior mechanical, electrical, magnetic and optical properties, more sustainable and cost-effective. This has made advanced materials and devices an attractive field to the industries related to automobile, information and communication technology, energy storage and energy conversion or any other industry concerning civil, defence or space applications. Research activities of the department are focused on Green energy materials and devices, Solar cells and LEDs, Ferroelectric and Multiferroic Materials, Piezoelectric materials for MEMS applications, Materials for Opto-chemical and fluorescence sensors, Molecular modeling and simulations of materials, Quantum dots, Metal-oxide nanostructures, and functional nanomaterials. Currently, *15 faculty members, and 14 research scholars* of the department are working in the area of Advanced Materials and Devices. *Seven research projects worth Rs. 153.67 Lac* received from various Govt. agencies has been completed/ ongoing. 16 PhD thesis and 30 M. Tech thesis have already been completed *and 262 research papers* (210 in peer reviewed international journals, 5 in peer reviewed national journals, 33 in international conferences, and 14 in national conferences) have been published in this area.

### **2. Photonics, Plasma and Quantum Computing**

The department is working on various aspects of applications in the field of photonics, plasma physics and quantum computing. The interaction of high power laser with plasma has emerged as a subject of world-wide subject due to its applications in laser fusion, particle accelerators, and radiation generation. Plasma can also be harnessed for waste disposal food processing and development of plasma medicine. Similarly, Photonics involves tremendous applications in communication, science and technology, medicine, image processing, defence, optical computing etc. Recently quantum computation and communication have evolved as very important fields of study as unconditional security achieved in quantum cryptography is un-achievable in classical world and as it can substantially speed-up computation if a scalable quantum computer is built. Research activities of the department are focused on photonic crystals and devices, optical fiber sensors, surface plasmon, higher order non-classical states, quantum cryptography, quantum gates and circuits, laser plasma interaction, and tera-hertz radiation generation. Currently, *8 faculty members, and 6 research scholars* of the department are working in the area of Photonics, Plasma and Quantum Computing. *Eight research projects worth Rs. 419.26 Lac* received from various Govt. agencies has been completed/ ongoing. 11 PhD thesis and 3 M. Tech thesis have already been completed *and 161 research papers* (140 in peer reviewed international journals, 5 in peer reviewed national journals, 15 in international conferences, and 1 in national conferences), and 4 books and 4 book chapters have been published in this area. In addition to above, two books have also been edited and another two books have been reviewed by this group.

## Research Profile of Department of Physics and Materials Science and Engineering

### GROUP-1 Advanced Materials & Devices

Thrust Areas	Faculty	Research Grant*	Research Students <sup>#</sup>	Research Publications <sup>@</sup>
<ul style="list-style-type: none"> <li>❖ Nanoscience and Nanomaterials</li> <li>❖ Energy Materials and Devices</li> <li>❖ Advanced Materials</li> <li>❖ Atomic and Molecular Physics</li> <li>❖ MEMS and Applications</li> </ul>	Prof. S C Katyal Prof. D K Rai Prof. S P Purohit Dr. R K Dwivedi Dr. P Chowdhury Dr. N Goswami Dr. Vikas Malik Dr. Manoj Kumar Dr. A P S Chauhan Dr. S Chhoker Dr. B C Joshi Dr. H. Pandey Dr. Dinesh Tripathi Dr. Anuj Kumar Dr. Manoj Tripathi	Received ₹ 153.67 Lac received various Govt. Agencies. Project Completed:05 Project ongoing: 02	Currently Working: 14 Ph.D. Degree Awarded: 16	International Journals: 211 National Journals: 05 Peer Reviewed Conference Publications: 46

### GROUP-2 Photonics, Plasma and Quantum Computing

Thrust Areas	Faculty	Research Grant*	Research Students <sup>#</sup>	Research Publications <sup>@</sup>
<ul style="list-style-type: none"> <li>❖ Laser plasma interaction</li> <li>❖ Photonic crystals and devices</li> <li>❖ Optical fiber sensor</li> <li>❖ Surface Plasmons</li> <li>❖ Terahertz radiation generation</li> <li>❖ Higher order non-classical states</li> <li>❖ Quantum communication</li> <li>❖ Quantum gates and circuits</li> </ul>	Prof. A Pathak Dr. N K Sharma Dr. Vivek Sajal Dr. S K Awasthi Dr. Amit Verma Dr. P Kumar Dr. A Varshney Dr. A. Panwar	Received ₹ 419.26 Lac received various Govt. Agencies. Project Completed:04 Project ongoing: 04	Currently Working: 06 Ph.D. Degree Awarded: 11	International Journals: 140 National Journals: 05 Peer Reviewed Conference Publications: 21 Books: 04 Book Chapters: 04 Books edited : 02 Books reviewed : 02

\*Details of research project funds in **Annexure-I/PMSE**

@Details of research publication (journals, conference proceedings, books) in **Annexure-II/PMSE**

#Details of students involved in research work/project/assignment ongoing/completed at Ph.D., M.Tech. and B.Tech. level are summarized in **Annexure-III/PMSE**, **Annexure-IV/PMSE**, and **Annexure-V/PMSE** respectively.

**FUNDED RESEARCH PROJECTS – Department of Physics and Materials Science and Engineering**

S. No.	Name of PI	Duration	Sanctioned Amount (in Lac)	Project Title	Funding Agency	Completed/Ongoing
1.	Prof. Anirban Pathak	2006-2009	2.16	Theoretical study of single photon sources used in quantum computing	DST	Completed
2.	Prof K.C.Mathur/ Prof. R. K. Dwivedi	2008-2011	7.00	Modernisation of Physics and Material Science & Engineering Lab	AICTE (MODROB)	Completed
3.	Prof. R. K. Dwivedi	2010-2012	16.12	Investigations on Multifunctional Properties in substituted Multiferroics	DRDO	Completed
4.	Dr. Manoj Kumar	2010-2014	11.58	Synthesis and study of structural, dielectric, magnetic and magnetoelectric properties of multiferroic materials	DST	Completed
5.	Dr. Papia Chowdhury	2010-2014	9.36	Bistability due to intr-molecular and inter-molecular charge transfer in different environments	DST	Completed
6.	Prof. R. K. Dwivedi	2011-2014	51.31	Investigations on Multifunctional Properties of alkaline earth and rare earth doped $BFe_{1-x}Ti_xO_3$ solid solutions	DST	Completed
7.	Prof. Anirban Pathak	2011-2014	12.75	Theoretical studies of higher order non-classicality and its applications	DST	Completed
8.	Prof. Anirban Pathak	2016-2019	39.50	Entangled and other nonclassical state and their applications in the field of quantum computation and communication	DST	Completed
9.	Prof. Anirban Pathak	2016-2019	34.07	Design and cryptanalysis of protocols of secure quantum communication	DRDO	Completed
10.	Dr. Sandeep Chhoker	2016-2019	11.00	Structurally manipulated stannate nanostructures for magnetic and optoelectronic applications	DST	Ongoing
11.	Dr. Navneet Kr. Sharma	2017-2020	27.71	Experimental investigations on surface plasmon resonance based fiber optic refractive index sensors	DRDO	Ongoing
12.	Dr. Himanshu Pandey	2018-2021	47.30	Investigation of Novel Heusler Alloy Thin films for Energy and Spintronic Applications	SERB	Ongoing
13.	Prof. Anirban Pathak	2019-2021	40.91	Design & Analysis of the Quantum Cryptographic Schemes that can be Implemented in the Metropolitan cities using Optical Resources	DRDO	Ongoing
14.	Prof. Anirban Pathak	2019-2022	222.16	Designing of Devices and Protocols for Quantum Hacking, Random Number Generation and Secure Communication	DST	Ongoing
15.	Prof. Anirban Pathak	2019-2021	40	Generation of Entangled Photons and its Applications to Quantum Computation and Information Processing	DST	Ongoing
			Total	572.93		

## Publications in International Journals

2018

1. S. Joshi, **M. Kumar**, **H. Pandey**, M. Singh and P. Pal, “Structural, magnetic and dielectric properties of  $Gd^{3+}$  substituted  $NiFe_2O_4$  nanoparticles” *Journal of Alloys and Compounds*, vol. 768, pp. 287-297, 2018. [Indexed in SCOPUS, Impact factor: 3.779]
2. S. Baliyan, M. Rafat, **A. Panwar**, **V. Sajal**, C. M. Ryu, “Magnetic field generation by amplitude modulated laser pulse in a rippled plasma” *Optik*, vol. 172, pp. 437-442, 2018. [Indexed in SCOPUS, Impact factor: 1.191]
3. P. Bhardwaj, **N. Goswami**, P. Narula, C. K. Jain, A. Mathur, “Zinc Oxide nanoparticles (ZnO NP) mediated regulation of bacosides biosynthesis and transcriptional correlation of HMG-CoA reductase gene in suspension culture of *Bacopa monnieri*”, *Plant Physiology and Biochemistry*, vol. 130, pp. 148-156 (2018). (Indexed in Scopus, Impact Factor: 2.718).
4. Thapliyal K., Sharma R. D., **Pathak A.**, “Orthogonal-state-based and semi-quantum protocols for quantum private comparison in noisy environment”, *International Journal of Quantum Information*, vol. 16, pp. 1850047, 2018.
5. Alam N., Mandal K. , **Pathak A.**, “Higher-order nonclassical properties of a shifted symmetric cat state and a one-dimensional continuous superposition of coherent states”, *International Journal of Theoretical Physics*, vol. 57, pp. 3443-3456, 2018.
6. Thapliyal K., **Pathak A.**, “Kak's three-stage protocol of secure quantum communication revisited: hitherto unknown strengths and weaknesses of the protocol”, *Quantum Information Processing*, vol. 17, pp. 229, 2018.
7. Bhardwaj S, Pal. A, Chatterjee K. H., Rana T. H, Bhattacharya. G, Sinha Roy. S, **Chowdhury. P**, Sharma. G. D, Biswas. S; Fabrication of efficient dye-sensitized solar cells with photoanode containing  $TiO_2$ -Au and  $TiO_2$ -Ag plasmonic nanocomposites, *J Mat Science: Materials in Electronics* (2018), 29, 21, 18209-18220.
8. Bhardwaj. S , Pal. A , Chatterjee. K, H Rana. T. H, Bhattacharya. G, Sinha Roy. S, **Chowdhury. P**, Sharma. G. D, Biswas. S; Enhanced efficiency of PbS quantum dot-sensitized solar cells using plasmonic photoanode. *J Nanopart Res*, (2018), 20, 198-213.
9. **S. K. Awasthi**, R. Panda, **P. K. Chauhan**, and L. Shiveshwari. “Multichannel tunable omnidirectional photonic band gaps of 1D ternary photonic crystal containing magnetized cold plasma.” *Physics of Plasmas* vol. 25, pp. 052103-1 - 052103-11, (2018) (Indexed in SCOPUS, Impact Factor = 2.115)
10. S. Sharma, **H. Pandey**, **M. Kumar** and **S. Chhoker**, “Room temperature ferromagnetism and electrical properties of Mn-doped  $Zn_2SnO_4$  nanorods” *Superlattices and Microstructures*, vol. 120, pp. 161-169, 2018. [Indexed in SCOPUS, Impact factor: 2.099]
11. R. Sharma, P. Thakur, **M. Kumar**, P. Sharma and V. Sharma, “Nanomaterials for high frequency device and photocatalytic applications: Mg-Zn-Ni ferrites” *Journal of Alloys and Compounds*, vol. 746, pp. 532-539, 2018. [Indexed in SCOPUS, Impact factor: 3.779]
12. **M. Kumar**, M. Arora, S. Chauhan and **H. Pandey**, “Structural, magnetic, dielectric, vibrational and optical properties of Zr substituted  $Bi_{0.90}Gd_{0.10}FeO_3$  multiferroics” *Journal of Alloys and Compounds*, vol. 735, pp. 684-691, 2018. [Indexed in SCOPUS, Impact factor: 3.779]
13. Pooja Singh, P. K. Rout, **H. Pandey** and Anjana Dogra, “Temperature-dependent space-

- charge-limited conduction in BaTiO<sub>3</sub> heterojunctions.” *Journal of Materials Science*, vol. 53, pp. 4806-4813, (2018). (Indexed in SCOPUS, Impact Factor = 2.993)
14. Shah K., **Sharma N. K.**, Sajal V., “Analysis of fiber optic SPR sensor utilizing platinum based nanocomposites”, *Optical and Quantum Electronics*, vol. 50, pp. 265, 2018. [Impact factor: 1.055]
  15. Shah K., **Sharma N. K.**, Sajal V., “Simulation of LSPR based fiber optic sensor utilizing layer of platinum nanoparticles”, *Optik*, vol. 154, pp. 530-537, 2018. [Impact factor: 0.835]
  16. A. Sahai, M. Mishra, G. Gupta and **Navendu Goswami**. “Structural, Vibrational and Electronic Properties of CuO Nanoparticles Synthesized via Exploding Wire Technique.” *Ceramic International*, vol. 44 (2), pp. 2478-2484 (2018). (Indexed in Scopus, Impact Factor: 2.758)
  17. **P. K. Chauhan**, Deepika Goel, **Anshu Varshney**, D. B. Singh and **Vivek Sajal**, “Parametric excitation of surface plasma waves over a metallic surface by laser in an external magnetic field”. *Laser and Particle Beams* Vol. 36, Issue 1, pp. 92-97, 2018. (Scopus Indexed, Impact factor: 1.7)
  18. Vijayeta Pal, A.Kumar, O.P. Thakur and **R.K. Dwivedi**, “Structural investigation of Ca/Zr co-substituted BaTiO<sub>3</sub> through XRD and Raman spectroscopy”, *Journal of Alloys and Compounds*, Vol. 741, Pages 707-714, April 15, (2018). (Indexed in SCOPUS, Impact Factor = 3.779)
  19. Subhash Sharma, Vikash Singh, Avneesh Anshul, J.M.Siqueiros, and **R. K. Dwivedi**, “Structural stability, Enhanced magnetic, piezoelectric and transport properties in (1-x)BiFeO<sub>3</sub> - (x)Ba<sub>0.70</sub>Sr<sub>0.30</sub>TiO<sub>3</sub> nanoparticles”, *Journal of Applied Physics* **123**[20], 204102, May 22, (2018). (Indexed in scopus, Impact Factor = 2.176)
  20. Vikash Singh, Subhash Sharma and **R.K. Dwivedi**, “Improved dielectric, magnetic and optical properties of Pr and Ti co-substituted BFO ceramics”, *J. alloy and Compounds*, Vol. 747, pp. 611-620, May 30 (2018). (Indexed in SCOPUS, Impact Factor = 3.779)
  21. **D. Tripathi** and T. K. Dey, “Co-current doping effect of nanoscale Carbon and Aluminium Nitride on critical current density and flux pinning properties of bulk MgB<sub>2</sub> superconductor.” *J. Low Temp Phys.*, vol. 191, pp. 136-152, 2018. (Indexed in SCOPUS, Impact Factor = 1.044).
  22. J. Naikoo, S. Banerjee, K. Thapliyal and **A. Pathak**. “Probing nonclassicality in an optically-driven cavity with two atomic ensembles.” *Physical Review A*, vol. 97, pp. 063840, 2018. (Indexed in SCOPUS, Impact Factor =2.44).
  23. A. Banerjee, K. Thapliyal, and **A. Pathak**. “Quantum Conference.” *Quantum Information Processing*, vol. 17, pp. 161, 2018. (Indexed in SCOPUS, Impact Factor = 2.17).
  24. N. Alam, A. Verma and **A. Pathak**. “Higher order nonclassicalities of finite dimensional coherent states: A comparative study.” *Physics Letters A*, vol. 382, pp. 1842-1851, 2018. (Indexed in SCOPUS, Impact Factor =1.772 ).
  25. M. Sosodia and **A. Pathak**. “Comment on “Quantum Teleportation of Eight-Qubit State via Six-Qubit Cluster State.”” *International Journal of Theoretical Physics*, vol. 57, pp. 516-522, 2018. (Indexed in SCOPUS, Impact Factor =0.964).
  26. **A. Pathak** and A. Ghatak. “Classical light vs. nonclassical light: Characterizations and interesting applications.” *Journal of Electromagnetic Waves and Applications*, vol. 32, pp. 229-264, 2018. (Indexed in SCOPUS, Impact Factor =1.21).
  27. M. Das, B. Sen, A. Ray and **A. Pathak**. “Lower order and higher order entanglement in four-wave mixing process.” *Annalen der Physik*, vol. 530, pp. 1700160, 2018. (Indexed in SCOPUS, Impact Factor = 3.039).

28. Bhardwaj. S., Pal. A., Chatterjee. K, H Rana. T. H. Bhattacharya. G, Sinha Roy. S, **Chowdhury. P**, Sharma. G. D, Biswas. S, “Significant enhancement of power conversion efficiency of dye-sensitized solar cells by the incorporation of TiO<sub>2</sub>-Au nanocomposite in TiO<sub>2</sub> photoanode” *J. Materials Sci*, vol. 53, pp. 8460-8473, (2018).
29. S. Kumar, S. Baliyan, M. Rafat, **V. Sajal**, “Combined effects of density ripples and transverse magnetic field on the suppression of stimulated Raman scattering of X-mode laser in a plasma”, *Optik* 166 (2018) 1-7.

## 2017

30. **Navendu Goswami** and P. Sen. “Water-driven Stabilization of Cadmium Sulphide Nanoparticles.” *Applied Surface Science*, vol. 425, pp. 576-584, 2017. (Indexed in SCI and Scopus, Impact Factor = 3.150)
31. R. Sharma, P. Thakur, **M. Kumar**, P.B. Barman, P. Sharma and V. Sharma, “Enhancement in A-B super-exchange interaction with Mn<sup>2+</sup> substitution in Mg-Zn ferrites as a heating source in hyperthermia applications” *Ceramics International*, vol. 43, pp. 13661-13669, 2017. [**Indexed in SCOPUS, Impact factor: 2.986**]
32. P. Thakur, R. Sharma, V. Sharma, P.B. Barman, **M. Kumar**, D. Barman, S.C. Katyal and P. Sharma, “Gd<sup>3+</sup> doped Mn-Zn soft ferrite nanoparticles: Superparamagnetism and its correlation with other physical properties”, *Journal of Magnetism and Magnetic Materials*, vol. 432, pp. 208-2017, 2017. [**Indexed in SCOPUS, Impact factor: 2.63**]
33. P. Bhandari and **V. Malik**. “Effect of increasing disorder on domains of the 2d Coulomb glass.” *Journal of Physics Condensed Matter*, vol. 29, pp. 485402, 2017. [**Indexed in SCOPUS, Impact Factor = 2.6**]
34. K. L. Mann, **V. Sajal**, P. Varshney, N. K. Sharma, “Terahertz radiation generation by pulse slippage of Cosh-Gaussian lasers in a corrugated magnetized plasma”, *Physics of Plasmas*, vol. 24, pp. 123117, 2017. [Impact factor: 2.115]
35. K. L. Mann, **V. Sajal**, N. K. Sharma, “Excitation of terahertz radiation generation by obliquely incident beating lasers on a hot magnetized plasma with step density profile”, *Laser and Particle Beams*, vol. 35, pp. 528-533, 2017. [Impact Factor: 1.42]
36. M. Sisodia, A. Shukla, K. Thapliyal and **A. Pathak**. “Design and experimental realization of an optimal scheme for teleportation of an n-qubit quantum state.” *Quantum Information Processing*, vol. 32, pp. 229-264, 2017. (Indexed in SCOPUS, Impact Factor = 2.192)
37. M. Sisodia, A. Shukla and **A. Pathak**. “Experimental realization of nondestructive discrimination of Bell states using a five-qubit quantum computer.” *Physics Letters A*, vol. 32, pp. 3860-3874, 2017. (Indexed in SCOPUS, Impact Factor = 1.772)
38. S. Aravinda, R. Srikanth and **A. Pathak**. “On the origin of nonclassicality in single systems.” *Journal of Physics A*, vol. 50, p. 465303 2017. (Indexed in SCOPUS, Impact Factor = 1.857)
39. C. Shukla, K. Thapliyal and **A. Pathak**. “Semi-quantum communication: Protocols for key agreement, controlled secure direct communication and dialogue.” *Quantum Information Processing* vol. 16, p. 295, 2017. (Indexed in SCOPUS, Impact Factor = 2.192)
40. M. Das, B. Sen, A. Ray and **A. Pathak**. “Lower order and higher order entanglement in 87Rb 5S-5P-5D hyperfine manifold modeled as a four-wave mixing process.” *Annalen der Physik*, 1700160 (2017). (Indexed in SCOPUS, Impact Factor = 3.039)
41. K. Thapliyal, N. L. Samantray, J. Banerji and **A. Pathak**. “Comparison of lower- and higher-order nonclassicality in photon added and subtracted squeezed coherent states.”

- Physics Letters A, vol. 381, pp. 3178-3187, 2017. (Indexed in SCOPUS, Impact Factor = 1.772)
42. M. Rana and **P. Chowdhury**. "Perturbation of hydrogen bonding in hydrated pyrrole-2-carboxaldehyde complexes." *Journal of Molecular Modelling*, vol. 23, pp. 216-227, 2017. (Indexed in SCOPUS, Impact Factor = 1.425)
  43. Pardeep K. Jha, Priyanka A. Jha, Prabhakar Singh, Rajeev Ranjan and **R. K. Dwivedi**, "Sm/Ti co-substituted bismuth ferrite multiferroics: reciprocity between tetragonality and piezoelectricity", *Physical Chemistry Chemical Physics*, vol. 19, pp. 2685-2695, 2017. (Indexed in SCOPUS, Impact Factor = 4.123)
  44. Pal Vijayeta, Kumar A., Thakur O.P., **Dwivedi R.K.**, Prasad N.E., Preparation, microstructure and relaxor ferroelectric characteristics of BLNT–BCT lead-free piezoceramics, *J. Alloys and Compounds*, vol. 714, pp. 725-735, 2017. (Indexed in SCOPUS, Impact Factor = 3.133)
  45. **S. K. Awasthi**, R. Panda and L. Shiveshwari. "Multichannel tunable filter properties of 1D magnetized ternary plasma photonic crystal in the presence of evanescent wave." *Physics of Plasmas*, vol. 24 pp. 072111-1 – 072111-2, 2017. (Indexed in SCOPUS, Impact Factor = 2.115)
  46. P. Varshney, **V. Sajal**, A. Upadhyay, J. A. Chakera and R. Kumar "Tunable terahertz radiation generation by nonlinear photomixing of cosh-Gaussian laser pulses in corrugated magnetized plasma" *Laser and Particle beams* 35, 279 (2017).
  47. P. C. Sati, **Manoj Kumar**, M. Arora, M. Tomar and V. Gupta, "Effect of Zr substitution on structural, magnetic, and optical properties of  $\text{Bi}_{0.9}\text{Dy}_{0.1}\text{Fe}_{1-x}\text{Zr}_x\text{O}_3$  multiferroic ceramics prepared by rapid liquid phase sintering method" *Ceramics International*, vol. 43, pp. 4904-4909, 2017. [Indexed in SCOPUS, Impact factor: 2.986]
  48. Seema Joshi, **Manoj Kumar**, Sandeep Chhoker, Arun Kumar and Mahavir Singh, "Effect of  $\text{Gd}^{3+}$  substitution on structural, magnetic, dielectric and optical properties of nanocrystalline  $\text{CoFe}_2\text{O}_4$ ", *Journal of Magnetism and Magnetic Materials*, vol. 426, pp. 252-263, 2017. [Indexed in SCOPUS, Impact factor: 2.63]
  49. P. C. Sati, Manisha Arora, **Manoj Kumar**, Monika Tomar and Vinay Gupta, "Effect of Pr substitution on structural, magnetic, and optical properties of  $\text{Bi}_{1-x}\text{Pr}_x\text{Fe}_{0.80}\text{Ti}_{0.20}\text{O}_3$  multiferroic ceramics", *Journal of Materials Science: Materials in Electronics*, vol. 28, 1011-1014, 2017. [Indexed in SCOPUS, Impact factor: 2.019]
  50. **Manoj Kumar**, Manisha Arora, Sunil Chauhan and Seema Joshi, "Raman spectroscopy probed spin-two phonon coupling and improved magnetic and optical properties in Dy and Zr substituted  $\text{BiFeO}_3$  nanoparticles", *Journal of Alloys and Compounds*, vol. 692, pp. 236-242, 2017. [Indexed in SCOPUS, Impact factor: 3.133]
  51. Prashant Thakur, Rohit Sharma, Vineet Sharma, PB Barman, Manoj Kumar, Dipto Barman, **SC Katyal** and Pankaj Sharma, " $\text{Gd}^{3+}$  doped Mn-Zn soft ferrite nanoparticles: Superparamagnetism and its correlation with other physical properties", *Journal of Magnetism and Magnetic Materials*, vol. 432, pp. 208, 2017.
  52. Subhash Sharma and **R.K. Dwivedi**, "Substitutionally driven phase transition and enhanced multiferroic and electrical properties of  $(1-x)\text{BiFeO}_3 - (x)\text{Pb}(\text{Zr}_{0.52}\text{Ti}_{0.48})\text{O}_3$  ceramics ( $0.0 \leq x \leq 1.00$ )", *J. Alloys and Compounds*, **692**, 770 – 773, 2017.
  53. Shah K., **Sharma N. K.**, Sajal V., "SPR based fiber optic sensor with bi layers of indium tin oxide and platinum: A theoretical evaluation", *Optik*, vol. 135, pp. 50-56, 2017. [Impact factor: 0.742]

54. **Sharma N. K.**, Shukla S., Sajal V., “Surface plasmon resonance based fiber optic sensor using an additional layer of platinum: A theoretical study”, *Optik*, vol. 133, pp. 43-50, 2017. [Impact factor: 0.742]
55. P. Bhandari, **V. Malik** and S. R. Ahmad, “Critical behavior of the two-dimensional Coulomb glass at zero temperature” *Phys. Rev. B*, vol. 95, pp. 184203, 2017.
56. Mishra, Kuldeep, S. S. Pundir, and **D. K. Rai**. “Effect of polysorbate plasticizer on the structural and ion conduction properties of PEO–NH<sub>4</sub>PF<sub>6</sub> solid polymer electrolyte.” *Ionics*, vol. 23, pp. 105-112, 2017. (Indexed in SCOPUS, Impact Factor = 2.062)
57. M. Rana and **P. Chowdhury**, “Perturbation of hydrogen bonding in hydrated pyrrole-2-carboxaldehyde complexes” *Journal of Molecular Modelling*, vol. 23, pp. 216, 2017.
58. M. Rana and **P. Chowdhury**, “Effects of hydrogen bonding between pyrrole-2-carboxaldehyde and nearest polar and nonpolar environment” *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, vol. 185, pp. 198, 2017.
59. M. Rana, N. Singla, **A. Pathak**, R. Dhanya, C. Narayana, **P. Chowdhury**, “Vibrational-electronic properties of intra/inter molecular hydrogen bonded heterocyclic dimer: An experimental and theoretical study of pyrrole-2-carboxaldehyde” *Vibrational Spectroscopy*, vol. 89, pp. 16-25, 2017.
60. C. Shukla, K. Thapliyal, **A. Pathak**, “Hierarchical Joint Remote State Preparation in Noisy Environment” *Quantum Information Processing*, vol. 16 p. 205, 2017.
61. A. H. Shenoy, **A. Pathak**, R. Srikanth, “Quantum cryptography: key distribution and beyond” *Quanta*, vol. 6, pp. 1-47, 2017.
62. R. D. Sharma, K. Thapliyal and **A. Pathak**, “Quantum sealed-bid auction using a modified scheme for multiparty circular quantum key agreement” *Quantum Information Processing*, vol. 16, p. 169, 2017.
63. K. Thapliyal, **A. Pathak**, S. Banerjee, “Quantum cryptography over non-Markovian channels” *Quantum Information Processing*, vol. 16, p. 115, 2017.
64. M. Sisodia, V. Verma, K. Thapliyal, **A. Pathak**, “Teleportation of a qubit using entangled non-orthogonal states: A comparative study” *Quantum Information Processing*, vol. 16, p. 76, 2017.
65. K. Thapliyal, R. D. Sharma, **A. Pathak**, “Protocols for quantum binary voting” *International Journal Quantum Information*, vol. 15, p. 1750007, 2017.
66. A. Banerjee, C. Shukla, K. Thapliyal, **A. Pathak**, P. K. Panigrahi, “Asymmetric quantum dialogue in noisy environment” *Quantum Information Processing*, vol. 16, p. 49, 2017.
67. A. Shukla, A. K. Pandey, **A. Pathak**, “Benford's distribution in extrasolar world: Do the exoplanets follow Benford's distribution?” *Journal of Astrophysics and Astronomy*, vol. 38, p. 7, 2017.
68. S. K. Giri, K. Thapliyal, B. Sen, and **A. Pathak**, “Nonclassicality in an atom–molecule Bose–Einstein condensate: Higher-order squeezing, antibunching and entanglement” *Physica A*, vol. 466, pp. 140-152, 2017.
69. R. Panda, M. Upadhyay and **S. K. Awasthi**. “Temperature Dependent Tuning of Defect Mode inside Photonic Bandgap for Cwdm Applications.” *Optics*, vol. 06, Issue 1, pp. 5-10, 2017.

**2016**



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### Books and Chapters

#### Book Publications:

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2. **A. Pathak** and A. Banarjee “Optical quantum information and quantum communication”, SPIE Spotlight Series, SPIE Press (2016); ISBN: 9781510602212.
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#### Edited Books:

5. A. Ghatak, **A. Pathak** and V. P. Sharma (Eds.) “Light and its Many Wonders”, Viva Books, New Delhi, India (2015); ISBN 978-81-309-3428-0.
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#### Book Chapters:

7. Deepika, Prashant Chauhan, Anshu Varshney, D. B. Singh, and **Vivek Sajal** “External Magnetic Field Effect on Absorption of Surface Plasma Waves by Metal Nanoparticles in Plasma and Fusion Science, Apple Press Academy, Canada (2016) ISBN:9781771884532 (Chapter 14).
8. A. Ghatak and **A. Pathak**, “Simple Interesting Experiments with Photons”, in Light and its Many Wonders, A. Ghatak, A. Pathak and V. P. Sharma (Eds.), Viva Books, New Delhi, India (2015); ISBN 978-81-309-3428-0; 119-137 (Chapter 8).
9. **A. Pathak**, “Optical Communication: Flaming Torch to Quantum Communication with Single Photons” in Light and its Many Wonders, A. Ghatak, A. Pathak and V. P. Sharma (Eds.), Viva Books, New Delhi, India (2015); ISBN 978-81-309-3428-0; 309-324 (Chapter 19).
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11. **V. Sajal** Reviewed: Sushil K. Tomar “A comprehensive book in Quantum Mechanics, Concepts & Practice, First Edition”, Exude Talent Publishing House, Ghaziabad (2016); ISBN 978-81-931770-0-6
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## Ph.D. Thesis

S. No.	Title of Thesis/ Dissertation/ Project	Names of Supervisors	Enrol. No. & Name of the Student	Status
<b>Group 1: Advanced Materials and Devices</b>				
1	Magnetism and magneto-transport in half and over doped manganites: Impact of substrate induced strain and polycrystalline disorder	Prof. R.K. Dwivedi, & Dr. H. K.Singh	064010062 Pawan Kumar	Completed
2	Preparation, Characterization and Battery Applications of Proton Conducting Polymer Electrolytes	Prof. D. K. Rai	08410061 Kuldeep Mishra	Completed
3	Exploring the proton transfer dynamics of some hydrogen bonded heterocyclic molecules in different environments	Dr. P. Chowdhury	10411064 Nidhi Singla	Completed
4	Multifunctional Properties of Doped Multiferroic	Prof. R.K. Dwivedi, & Dr. M. Kumar	9410061 Vikash Singh	Completed
5	Some Studies on Linear and Nonlinear Optical properties of Intraband Transitions in Silicon Quantum Dots	Prof. S. P. Purohit & Prof. K. C. Mathur	9410063 Anchala	Completed
6	Study of isovalent and aliovalent ions substitution in BiFeO <sub>3</sub> multiferroic ceramics	Dr. M. Kumar & Dr. V. Sajal	10411061 Prakash C. Sati	Completed
7	Studies on structural, dielectric and piezoelectric properties of lead free ceramics synthesized by semi-wet method	Prof. R. K. Dwivedi	10411065 Vijayeta Pal	Completed
8	Synthesis and characterization of multiferroic nanomaterials	Dr. M. Kumar	10411063 Manisha Arora	Completed
9	Investigations on structural, dielectric and piezoelectric properties of PZT-PVDF composites	Dr. G. Srivastava	11411607 Vineet Tiwari	Completed
10	Light emitting diode and solar cell	Dr. B. C. Joshi	12411604 Vanita Devi	Completed
11	Preparation and characterization of ferroelectric bulk and thin film materials	Prof. R. K. Dwivedi	10411062 Subhash Sharma	Completed
12	Investigations on structural and electrical behaviour of substituted bismuth ferrite multiferroics ceramics	Prof. R. K. Dwivedi	11411608 Pardeep Kumar	Completed
13	Some Studies of Electronic and Optical Properties in Atomic Structures and Nanostructure	Prof. S. P. Purohit & Prof. K. C. Mathur	10411068 Deepti Maikhuri	Completed
14	Synthesis and Characterization of Metal Oxide Nanostructures	Dr. N. Goswami	11411604 Anshuman Sahai	Completed
15	Synthesis and characterization of multifunctional nanostructures	Prof. S. C. Katyal & Dr. M. Kumar	11411606 Sunil Chauhan	Completed
16	Synthesis and characterization of nanofunctional materials	Dr. M. Kumar	12411603 Seema Joshi	Completed

17.	Ion transportation studies of some ionic liquid based solid electrolytes	Prof. D. K. Rai	9410062 Saurabh Singh Pundir	Ongoing
18	Polymer matrix composites	Dr. A. P. S. Chauhan	12410605 Komal Chawla	Ongoing
19	Synthesis and optical properties of pure and doped oxide nano structures	Dr. S. Chhoker	14410001 Shalu Sharma	Ongoing
20	To study optical and electrical properties of quantum dots	Dr. P. Chowdhury	14410004 Meenakshi Rana	Ongoing
21	Polymer electrolytes based sodium ion batteries	Prof. D. K. Rai and Dr. Kuldeep Mishra	16410001 Harshlata Verma	Ongoing
22	Synthesis and Characterization of Nano materials	Dr. N. Goswami and Prof. S. C. Katyal	16410002 Surendra Singh	Ongoing
23	Some studies of Atomic and Nanostructures	Prof. S. P. Purohit	17410001 Sukanya Nasa	Ongoing
24	Experimental Investigation on SPR Based Fiber Optic Refractive Index Sensors	Dr. N. K. Sharma	1819006 Vicky Kapoor	Ongoing
25	Synthesis and Characterization of nanoparticles	Dr. N. Goswami	18410001 Divya Chawla	Ongoing
26	Magnesium Ion Conducting Polymer Electrolyte for Battery Applications	Prof. D. K. Rai	18410002 Chandan Yadav	Ongoing
27	Rare Earth Doped Complex Selenium Based Chalcogenides for Mid to Far Infrared Application	Prof. S. C. Katyal	18410003 Chandresh Kumari	Ongoing
28	Composite Polymers	Dr. A. P. S. Chauhan	18410004 Sheetal Sharma	Ongoing
29	Functional Pervoskites Oxides	Prof. R. K. Dwivedi	18410006 Pushpender Chouhan	Ongoing
30	Studies of Optical and Chemical Properties of Some Nanosize Material and Quantum Dots	Dr. P. Chowdhury	18410007 Pooja	Ongoing
<b>Group 2: Photonics, Plasma and Quantum Computing</b>				
1	Theoretical study of higher order non-classicality in intermediate states	Prof. A. Pathak	64010063 Amit Verma	Completed
2	Synthesis, optimization and testing of reversible & quantum circuits	Prof. A. Pathak	64010064 Anindita Banerjee	Completed
3	Studies on surface plasmon resonance based fiber optic sensors	Dr. N. K. Shrama	11411603 Mahima Rani	Completed
4	Design and Analysis of Quantum Communication Protocols	Prof. A. Pathak and Dr. A. Verma	11411602 Chitra Shukla	Completed
5	Synthesis and Characterization of doped ZnO	Dr. R. Kumar and Dr. V. Sajal	10411066 Gunjan Srinet	Completed
6	Terahertz Radiation Generation by Laser Beating in a Magnetized Plasma	Dr. V. Sajal and Dr. R.	11411605 Prateek	Completed

		Kumar	Varshney	
7	Theoretical studies on surface plasmon resonance based fiber optic sensors with different materials	Dr. N. K. Shrama	13411601 Sarika Shukla	Completed
8	Interaction of Electromagnetic wave with surface plasmons	Dr. P. K. Chauhan	12411601 Deepika Goel	Completed
9	Parametric instabilities in a magnetized plasma	Dr. V. Sajal	12410606 Kanika Verma	Completed
10	Investigation of Electromagnetic wave propagation in Photonic Crystal	Dr. S. K. Awasthi	11411601 Maitreyi Upadhyay	Completed
11	A theoretical study of nonclassical effects in optical, atomic & optomechanical systems & their potential applications	Prof. A. Pathak	14410002 Kishore Thapliyal	Completed
12	Terahertz radiation generation laser plasma interaction	Dr. V. Sajal	15410004 Kusum L. Mann	Ongoing
13	Design and analysis of protocols quantum communication optical resources	Prof. A. Pathak	15410006 Mitali Sisodia	Ongoing
14	Surface Plasmon based Fiber Optics, chemical sensors	Dr. N. K. Sharma	15410007 Kruti Shah	Ongoing
15	Higher order non classical states of electromagnetic radiation	Dr. A. Verma	16410004 Kathakali Mandal	Ongoing
16	Generation and Applications of Nanclassical and Non-Gaussian States	Prof. A. Pathak	16410005 Ashwin Saxena	Ongoing
17	Photonics crystal applications	Dr. Anshu D Varshney and Dr. P. K. Chauhan	18410010 Sujeet Kumar	Ongoing

**M. Tech. Dissertation**

S. No.	Title of Thesis/ Dissertation/ Project	Names of Supervisors	Enrol. No. & Name of the Student	Status
<b>Group 1: Advanced Materials and Devices</b>				
1	Studies on synthesis and magneto-electrical properties of manganites	Prof. R K. Dwivedi	06311201 Anubha Gupta	Completed
2	Quantum analysis of spectroscopic behaviour of pyrrole derivative and its experimental verification	Dr. Papiya Chowdhury	06311202 Neeraj Kumar	Completed
3	Synthesis and Characterization of Metal-Polymer Nanocomposites	Dr. Navendu Goswami	06311203 Anurag Prasad	Completed
4	Synthesis and Characterization of Zinc Oxide Nanostructures	Dr. Navendu Goswami	06311204 Dhirendra Kumar Sharma	Completed
5	Studies on proton conduction composite solid electrolyte	Prof. D. K. Rai	07311202 Kapil Malik	Completed
6	Studies on proton conduction gels	Prof. D. K. Rai	07311203 Somya Hasan Ahmad Ben	Completed
7	Photophysical and photochemical study of organic and inorganic material	Dr. Papiya Chowdhury	07311205 Rakesh Kumar	Completed
8	Studies on Magneto-electrical properties of manganites	Prof. R K. Dwivedi	07311208 Vikash Singh	Completed
9	Studies on dielectric behavior doped perovskite oxide materials	Prof. R K. Dwivedi	07311209 Arvind Kumar	Completed
10	Host guest inclusion complex with cyclodextrin	Dr. Papiya Chowdhury	07311210 Salahuddin Mohammad	Completed
11	Optical and magnetic properties of Mn doped ZnO diluted magnetic semiconductor	Dr. Ravindra Kumar & Dr. Vivek Sajal	08311951 Gunjan Srinet	Completed
12	Synthesis and characterization of lead free piezoelectric ceramics	Prof. R K. Dwivedi	08311953 Vijayeta Pal	Completed
13	Synthesis and characterization of ZnO Nanomaterial	Dr. Navendu Goswami	08311954 Vinod Kumar Sharma	Completed
14	Synthesis and Characterization of a proton conducting gel	Prof. D. K. Rai	08311955 Sanjay Singh Yadav	Completed
15	Synthesis & characterization of Nano-based composites in micellar system	Dr. Papiya Chowdhury	08311956 Prakash Sati	Completed
16	Synthesis and studies on dielectric behavior of functional Perovskite oxides	Prof. R K. Dwivedi	09311952 Mahesh Pal Singh	Completed
17	Synthesis of nanomaterials and their characterization for structural, optical, electronic and electrical properties	Dr. Navendu Goswami	09311954 Anshuman Sahai	Completed

18	SnO <sub>2</sub> /PAni Nanocomposite: Investigation of Gas Sensing Applications	Dr. Navendu Goswami	10311203 Amit Badola	Completed
19	Optimization of design parameters of Piezoelectric properties for uni-morph cantilever	Prof. R. K. Dwivedi & Dr. Geetika Srivastava	10311205 Rashiya Sharma	Completed
20	Synthesis and Characterization of Nitrogen Doped ZnO Nanoparticles	Dr. Navendu Goswami	10311206 Renu Kumari	Completed
21	Synthesis and characterization of Ba <sub>1-x</sub> Bi <sub>x</sub> TiO <sub>3</sub> ceramics	Prof. R. K. Dwivedi & Dr. Ravindra Kumar	11310203 Ranvir Singh Chauhan	Completed
22	Synthesis and Characterization of Multiferroic Nanoparticles	Dr. Manoj Kumar	11411606 Sunil	Completed
23	Optical and magnetic properties of Co doped ZnO diluted magnetic semiconductor	Dr. Ravindra Kumar & Dr. Vivek Sajal	11411605 Prateek Varshney	Completed
24	Preparation and characterization of ion conducting polymer electrolyte	Prof. D. K. Rai	12311201 Supriya Srivastava	Completed
25	Polymer baser optical sensors	Dr. Papiya Chowdhury	12311203 Ashish Tripathi	Completed
26	InGaN/GaN Multi Quantum wells light emitting diodes	Dr. B.C. Joshi	12311204 Jaya Singh	Completed
27	Synthesis & characterization of carbon black and carbon black-composites	Dr. A. P. S. Chauhan	13311203 Kauslendra Pandey	Completed
28	Droop improvement in InGaN/GaN LEDs	Dr. B.C. Joshi	13311204 Gaurav Pratap Singh	Completed
29	Investigation of Nanosized Copper by Polyol Technique in Carbon Environment	Dr. A. P. S. Chauhan	13311206 Santhoshkumar Mahadevan	Completed
30	Investigation of Nano-Material Prepared by Exploding Wire Technique (EWT)	Dr. Navendu Goswami	13311206 Santhoshkumar Mahadevan	Completed
<b>Group 2: Photonics, Plasma and Quantum Computing</b>				
1	Synthesis and Study of Electro-Optical Properties of Metal Doped Oxides and Doped Polymers	Prof. Anirban Pathak	07311207 Saurabh Singh Pundir	Completed
2	Fabrication and characterization of optical thin films	Dr Navneet Kr Sharma	08311952 Subhash	Completed
3	Studies on prism based surface plasmon resonance sensors	Dr Navneet Kr Sharma	12311202 Swati Yadav	Completed

## B. Tech. Projects

S. No.	Enrol. No. & Name of the Student	Title of Thesis/ Dissertation/ Project	Names of Supervisors	Level (PhD/M. Tech./B.Tech.)	Status (Completed/Ongoing)
<b>Group 1: Advanced Materials and Devices</b>					
1	Suresh	Protein folding	Dr. Papia Chowdhury	B. Tech.	Completed
2	14103017 Anuksha Jain	Advance Garbage Monitoring System	Dr. B.C. Joshi	B. Tech.	Completed
3	14102103 Diksha				
4	15102212 Mohit Garg		Dr. B.C. Joshi	B. Tech.	Completed
2	15102089 Himanshu Singh	Simulation of project: simulation of piezoelectric energy harvesting devices	Prof. R. K. Dwivedi	B. Tech.	Completed
3	15102028 Vibhor Bansal	Simulation of project: simulation of piezoelectric energy harvesting devices	Prof. R. K. Dwivedi	B. Tech.	Completed
4	Asmita Mittal	Effect of Solvent on Structure of ZnS Nanoparticles: A Molecular Dynamics Simulation Study	Dr. Navendu Goswami	B. Tech.	Completed
5	Gaurav Agarwal				
6	Ankit Marwah				
7	Spandan Kaur Kalra	Designing a Biosensor Using Nanoparticles	Dr. Navendu Goswami	B. Tech.	Completed
8	Saket Gupta				
9	Anisha Kharkia				
10	Saroj Kumar	To Design an Industrial Glucose Biosensor using Nanoparticles	Dr. Navendu Goswami	B. Tech.	Completed
11	Poonam Gupta				
12	Shyam Prakash				
<b>Group 2: Photonics, Plasma and Quantum Computing</b>					
1	Rishabh Jain	Real Time Multi-Site Photo-Stimulation of A Neural Tissue Using A Digital Micro-Mirror Device	Prof. A.Pathak	B. Tech.	Completed (August, 2005)
2	Prakash Gupta	Physical Model of A River	Prof. A. Pathak	B. Tech.	Completed (May, 2005)
3	Pratap Narayan Pandey	Quantum Cryptography with Single Photon Source	Prof. A. Pathak	B. Tech.	Completed (May, 2005)
4	Manu Gupta	Distributed Quantum Computing Using Non-Local Quantum Gates and Related Studies	Prof. A. Pathak	B. Tech.	Completed (May, 2005)
5	Abhishek Santosh Gupta	Quantum Algorithms for Some Simple Problems	Prof. A.Pathak	B. Tech.	Completed (May, 2005)
6	Ankit Dalmia	Enhancing the Role of Captcha in Data Security	Prof. A. Pathak	B. Tech.	Completed (May, 2006)