1. **Contributions to research and development**

I have a total of 20 journal publications (all as the first author) with 1 additional submitted manuscript under review and total citations of my publications is 62 (provided by Google Scholar June/2020) along with **one patent.**

1. **Articles published or accepted in refereed journals (20 manuscripts).**

**Dawar, P.**, Raghava, N.S. and De, A. (2019) UWB metamaterial loaded antenna for C- band aplications.Int. J. Antenna Propagation, HINDAWI.**13** (PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2018) S-shaped metamaterial ultra-wideband and Directive patch antenna.Radioelectron. Commun. Syst., SPRINGER.**61:**9(PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2018) UWB, miniaturized and directive metamaterial loaded antenna for satellite aplications. Int. J. Networked Distrib. Comput.(PhD work)

**Dawar, P.**,Raghava,N.S. and De,A. (2018) UWB and miniaturized meandered stripline fed metamaterial loaded antenna for satellite aplications. IOP conference series: Material Science and Engineering Journal. (PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2017) Miniaturized UWB multi-resonance patch antenna loaded with novel modified H-shape SRR metamaterial for microspacecraft application. Front. Inf. Technol. Electron. Eng.**18**:11.(PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2016) Directive and Broadband 4-seg SRR Metamaterial Antennas.Int. J. Adv. Sci. Technol. **97**.(PhD work)

**Dawar, P.** , Raghava, N.S. and De,A.(2016) Ultra Wide Band , Multi-resonance Antenna using swastika metamaterial. International Journal of Microwave and Optical Technology. **11**: 6(PhD work)

**Dawar, P.**, De, A and Raghava, N.S. (2016) UWB and Directive E-shaped metamaterial patch antenna. Materials Research Innovations, Taylor and Francis.**20**:240-246 (PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2016) High gain, directive and miniaturized metamaterial C-band antenna. Cogent OA Physics, Taylor and Francis. **3**: 1236510(PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2015) A novel metamaterial for miniaturization and multi-resonance in antenna. Cogent OA Physics, Taylor and Francis. **2:**1(PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2015) Tunable and directive metamaterial-inspired antennas for C Band Aplications.International Journal of Microwave and Optical Technology.**10**:168-175(PhD work)

**Dawar, P.** and De, A. (2015) Bandwidth and gain enhancement of RPA using C shaped metamaterial at THz. International Journal of Scientific World. **3:** 59-68(PhD work)

**Dawar, P.**, Raghava, N.S. and De, A. (2015) FEM and Transmission line based analysis of Closed Ring Pair metamaterial. International Journal of Signal Processing, Image Processing and Pattern. **8**:351-356(PhD work)

**Dawar, P.** and De,A.(2014)Tunability of Triangular SRR and Wire Strip (TSRR-WS) metamaterial at THz. Advances in Optical Technologies, Hindawi Journal.**2014:**405301(PhD work)

**Dawar, P.** and De, A. (2014) Effect of splits in resonance permeability of ESRR metamaterial at THz. Procedia Materials Science Journal, Elsevier.**2014**:1936-1941(PhD work)

**Dawar, P.** and De,A.(2013) Bandwidth Enhancement of RMPA using 2-Segment Labyrinth Metamaterial at THz. Materials Sciences and Application. **4**:579-588.(PhD work)

**Dawar, P.** (2012) Analysis of branch line coupler using Sonnet lite. International Journal of Electronics & Communication Technology. **3**:1(Master's work)

**Dawar, P.** (2011) Design and simulation of magic tee and ring hybrid coupler using Ansoft HFSS. International Journal of Computer Science and Technology. **2**:199-202(Master's work)

**Dawar, P.** (2011) C-V characterization of GaAs MESFET.International Journal of Electronics & Communication Technology. **2:**53-54(Master's work)

**Dawar, P.** (2010) Design and simulation of rotary field ferrite phase shifter using Ansoft HFSS.Special issue of IJCCT for ACCTA- 2010. **1**:111-115.(Master's work)

1. **Other refereed contributions (Total 11 (as first author) of conference abstracts and proceedings papers, 4 listed here).**

**Dawar, P.** (2010) D. C. characterization of 0.7 microns X 150 microns GaAs MESFET.NCEEE-2010, **National Conference**, Oral Presentation (Master's work)

**Dawar, P.** (2010) Lithium ferrite characterization. NCEEE 2010, **National Conference**, Oral Presentation(Master's work)

**Dawar, P.** (2010) Comparative Analysis of Microstrip and Stripline using Sonnet lite. NCETCIT 2011, AICTE sponsored **National Conference**, Oral presentation(Master's work)

**Dawar, P.** and De, (2010) A Planar Antenna Design Using Metamaterials at high frequencies: A Review. AET 2013, jointly organized by the ACEEE, AMAE and ACEE and sponsored by ISTE, **International Conference**, Oral Presentation(PhD work)

1. **Patent**

**Dawar, P.** (2020) System and method to predict Rheumatoid Arthritis (RA).India Patent No. 202041023528, 12th June, 2020

1. **Most significant contributions to research and development**

**Contribution (1):** I have designed, simulated and fabricated a novel microstrip patch antenna with modified H-shaped Split Ring Resonator metamaterial in the middle of its substrate. The rectangular patch antenna has 65% lessened active area obtained by cutting a circle of radius 12 mm on its top. The proposed metamaterial was placed in the middle of the substrate such that its center coincides with the center of the patch. This work was carried in Department of Electronic Science, South Campus, Delhi, India. It includes design, fabrication and testing of this antenna. In literature, using similar shapes of metamaterial, the bandwidth was increased by 130% and radiation efficiency of 86%. However, using modified H-shaped metamaterial in the middle of antenna’s substrate, bandwidth increased by 6.5 times and radiation efficiency of 100% was achieved.

**Contribution (2):** I have measured phase shift characteristics of C-band phase shifters constructed from lithium ferrites. The ferrite in crystalline form was formed using ball milling, sintering etc. and further characterized using X-ray crystallography, testing was done using toroidal shape transformer. This fabrication and characterization work has been conducted in collaboration with Solid State Physics Laboratory, Defense Research Development Organisation, India. The design of rotary field phase shifter consisted of central field rotatable half wave plate coupled at each end to fixed quarter wave plates that in turn couple to transducers to waveguide or other transmission structure. This was implemented in Ansoft HFSS by first magnetizing the ferrite rod in perpendicular (to direction of propagation) direction and then in longitudinal (parallel to the direction of propagation). Thereby, giving a phase shift of 180 degrees for the first time in the esteemed laboratory.

**Contribution (3):** I have done MESFET (Metal Semi-conductor Field Effect Transistor) fabrication and characterization in GaAs Laboratory of SSPL, DRDO, India. RF sputtered Ti/Pt/Au Schottky contacts with varying titanium thickness were been made on (n) GaAs by the lift-off process under actual device processing conditions. These contacts were next used to fabricate submicron gate length GaAs MESFETs. The MESFET's gm increased with improved gate diode ideality but was not a strong function of it. The effect of Schottky gate annealing on the MESFET's dc characteristics was studied and published.

**Contribution (4):** An aspect of my patent disclosure relates to system and method to predict rheumatoid arthritis (RA). The system includes one or more processors and non-volatile computer memory. The processors execute a plurality of computer-readable instructions. The non-volatile computer memory stores the computer-readable instructions configured to normalize rheumatoid arthritis (RA) dataset stored in an arthritis database; split the RA dataset to a training dataset and a testing dataset from the RA dataset; extract a plurality of features by performing a harmonic search; train the extracted features; classify the RA dataset by an Adaptive Neuro-Fuzzy Inference System (ANFIS) model; and predict rheumatoid arthritis (RA) based on the classified RA dataset.

1. **Applicant's statement**
2. **Research Experience:**

**Fabrication and Measurement**: I have worked during my academic career with many research groups in different academic disciplines. I have worked during my bachelors for three summer internships in MMIC (Microwave Monolithic Integrated Circuits laboratory) and RF Devices SAG (Scientific Analysis Group) Lab in Defense Research Development Organisation, India resulting in one journal publication as first author. I spent the first year internship in doing MESFET fabrication and its Capacitance-Voltage (C-V) characterization. I have worked during my masters for one final semester internship in MMIC Lab resulting in one journal publication as the first author. I did ferrite rod and toroid fabrication along with its microwave characterization. In my doctoral studies, the proposed microstrip patch antenna designs were first simulated and further fabricated using FR4 substrate. This resulted in five journal publications where bandwidth and radiation efficiency were improved drastically followed by congruence between simulation and fabrication results. Testing was majorly carried out at my alma-maters, including Department of Electronic Science, Delhi University. They provided me substrates for fabricating the antennas using LPKF printer and testing of antennas’ gain using horn antenna set-up of the microwave lab. However, for antennas working in higher frequency regions, I did testing on Vector Network Analyser for return loss and VSWR measurements in collaboration with Bharti Airtel R&D laboratory.

**Simulation**: In the second year bachelor’s internship at MMIC Lab, I prepared literature review on Heterojunction Bipolar Transistor (HBTs) followed by study of various planarizing techniques for wafer. In the third year bachelor’s internship at SAG lab, I designed a low pass Chebyshev filter using advanced mathematical techniques and verified it using software simulation. In my master’s thesis, I designed ferrite rod on Ansoft HFSS which was simulated for the first time in Solid State Physics laboratory, DRDO, India.

**Documentation**: After my masters I wrote two self-authored books on Electromagnetic Field Theory designed for syllabus of Guru Gobind Singh Indraprastha University and Uttar Pradesh Technical University respectively. In the first two years of my PhD, I engrossed myself in finishing the academic course requirements, studying different potential PhD projects, and later familiarizing myself with the literature of the chosen project. I chose my project with the guidance of my supervisor who was stalwart in that area. I began exploring new domain i.e. from devices to planar antennas. In further six months in Delhi Technological University, I was able to carry out an extensive literature review which got published in Elsevier, followed by another two authored presentations in renowned conferences in antenna and microwave domain, namely, International Conference on Microwaves, Antenna, Propagation & Remote Sensing (ICMARS) and IEEE Antenna and Propagation Society (APS/URSI). The method of analyzing metamaterials with transmission line circuit analysis was later applied to several academic studies catering to applications in frequency bands ranging from GHz to THz leading to eleven journal publications as the first author. Finally, I also recently studied a novel method of generation of high magnetic moment using toroidal dipole response in metamaterials. This I incorporated in planar antenna design using superstrates which has application as capacitive energy harvester. This is a result of collaborative work with a professor in MTC College, Egypt and paper is currently under review with me as the first author.

1. **Relevant activities**

**Supervisory:** I supervised a decade of major (6 months) and minor project (6 months) thesis officially at my workplace (Guru Tegh Bahadur Institute of Technology) for third year and final year bachelors’ students. Two of them got published in ICC Journal in 2019 recently titled, “RC Car Using Lab VIEW and Arduino” and “Robotic Arm Control using Lab View”.

**Talks (by invitation):** I gave a talk at the Sixth International Conference on Signal Processing and Communication (ICSC 2020) from March 5-7, 2020 which was organized by the Department of Electronics and Communication Engineering, JIIT Noida, India. The Conference was being technically co-sponsored by IEEE and I was also a session chair.

**Volunteer Work: 1)** Member of the technical committee of ICCTD 2011 (peer reviewer) **2)** Member of technical committee of PDCTA 2014 (peer reviewer). **3)** Reviewer of COMPEL journal (SCI Indexed) **4)** Reviewer of GUCON 2019, IEEE conference, India. **5)** Committee member of ISPECE-2019, China. **6)** Committee member of REDSET-2019, SPRINGER, India.

**Workshops/sessions organised:** **1)** Guest editor of special session, “Application of Metamaterials in Antennas at high frequencies including THz,” in IEMIS-2020. **2)** Guest editor of special session, “Application of Metamaterials in Antennas at high frequencies including THz,” in ICICC-2020. **3)** Guest editor of special session, “Application of Metamaterials in Antennas at high frequencies including THz,” in ICICC-2019. **4)** Short Term Course on “Next Generation Wireless technologies” through ICT in association with National Institute of Technical Teachers Training and Research (NITTTR), Chandigarh, GTBIT, 26th -30th Nov 2018. **5)** Short Term Course on “Virtual Instrumentation” through ICT in association with NITTTR, Chandigarh, GTBIT, 28th April -2nd May, 2014. **6)** Short Term Course on “MATLAB and its Applications” through ICT in association with National Institute of Technical Teachers Training and Research (NITTTR), Chandigarh, GTBIT, 15th -19th Sept 2014. **6)** Short Term Course on “VLSI Design” through ICT in association with National Institute of Technical Teachers Training and Research (NITTTR), Chandigarh, GTBIT, 5th -9th Oct 2015.

**Media:** I am Open Educational Resources (OER) Instructor at Progia Learnware for the course of Optical Communication at undergraduate (UG) level since 2013.

**Article Recognition:** **1)** My article became issue and reference for submitting in Taylor and Francis Journal, “High gain, directive and miniaturized metamaterial C-band antenna”, is in an issue of Cogent Physics, Issue 1 and is Open Access. **2)** My article became the “Most read article in 2016” in Taylor and Francis Journal: “A novel metamaterial for miniaturization and multi-resonance in antenna”.