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UNIVERSITY PRIORITY SETTING REPORT FOR THE PROVISION OF RESEARCH AND EDUCATION

UNIVERSITY OF HYDERABAD, INDIA

Integrating Talent Development into Innovation Ecosystems in Higher Education

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This report seeks to map priority areas for research and education provision at the University. It aims to provide a vision on how the institution can develop further to become innovation and skills provider for its region and locality, and how students and graduates should be involved in this process.

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Review of national priorities for research, innovation and education

NATIONAL PRIORITIES FOR RESEARCH, INNOVATION AND EDUCATION AS REFLECTED IN THE RESEARCH AGENDA OF UNIVERSITY OF HYDERABAD

The Government of India has recently launched several initiatives in the field of higher education, such as Global Initiative of Academic Networks (GIAN), Impacting Research, Innovation and Technology (IMPRINT), Impactful Policy Research in Social Science (IMPRESS), Scheme for Promotion of Academic and Research Collaboration (SPARC), VAJRA (Visiting Advanced Joint Research) Faculty Scheme, SWYAM, Scheme for Trans-disciplinary Research through Higher Education Institutes for National Development and Entrepreneurship (STRIDE), etc. These are the recent initiatives of the Government of India to promote research (including innovation), pedagogy, and entrepreneurship across disciplinary boundaries. Most of these schemes aim at contributing to internationalization of higher education in India through joint research, exchange of faculty and students. This in turn is expected to improve quality of higher education and encourage innovations. Most of these initiatives are aimed at strengthening infrastructure in the HEIs and on focusing on inculcating the culture of research and entrepreneurship among the students.

A closer look at these initiatives suggests that the following research areas are currently prioritized at national level:

- Research conducted on the basis of international collaboration, involving both academics and entrepreneurs
- Research focused on or informed by the major science and engineering challenges that India must address in order to enable and empower inclusive growth and self-reliance
- Social science research in policy-relevant areas so as to provide vital inputs in policy formulation, implementation and evaluation
- Trans-disciplinary research
- Socially inclusive innovations for national development and entrepreneurship
- New ideas, concepts and practices for promoting the public good and strengthening civil society.

Further, making research and knowledge accessible to all, including the most disadvantaged learners, is also a major priority.

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University priorities for research and innovation targeted at the economy and business enterprises

University of Hyderabad (UoH) is one of the major institutions of higher education in the country. It is devoted to postgraduate studies and excellence in research.

- The major strength of the university is its renowned faculty. Several faculty members are known for their excellent teaching skills and cutting edge research in basic and applied sciences and technology.
- Over the years the university has established excellent infrastructural facilities that can be compared with the best laboratories in the country and abroad.
- The strong academia-industry research collaboration of University of Hyderabad gives its faculty members an edge and ensures high visibility and societal relevance of their research. This in turn helps students secure placement in reputed companies.
- Over the years, University of Hyderabad has built high-end research and outreach infrastructure that can be utilized for start-ups to perform innovative research through business incubation. Notable structures at the University include BioNEST, Biotech Incubation Centre, Technology Business Incubation (TBI) and Technology Incubation for Development of Entrepreneurship (TIDE).
- To promote research interactions with industry and to nurture entrepreneurship culture at University of Hyderabad, the Technology Industrial-Liaison Entrepreneurship-Unit (TIE-U) was established recently. A Section 8 Company, Association for Scientific Pursuits for Innovative Research Enterprises (ASPIRE) has been established at the University for promoting the translation of research into practical pursuits. All exiting incubators and forthcoming incubators will work under ASPIRE.

CURRENT COLLABORATIONS FOR RESEARCH AND EDUCATION

- **MoU or MoA with industry/clusters/associations**

The university has collaborations with several prominent industries across the country e.g. Dr. Reddy's Laboratories, Sun Pharma, Unique Biotech, Aurobindo pharma, MEIL, SMI, MIDHANI etc. A glimpse is presented below:

Some of the collaborations of University of Hyderabad with Pharma and Biotech Based Industries

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Some of the collaborations of University of Hyderabad with Material Engineering Industries

- **Patent awareness (Centre/Cell)**

Since its inception, the University has been engaged in research activities of high quality. However, in the recent past the University began to expand its activities into technology and applied areas, in order to bring the benefits of research and development and expertise to the society at large. Towards this end, the university is taking appropriate measures for promoting interdisciplinary studies. In order to help the faculty in securing intellectual property, the university has set up a patent cell. In addition, it outsources some activities to various agencies for filing the patents.

- **Incubation**

Recognising the importance of incubation centres in catalysing the knowledge base and in translating high quality science into technologies through start-ups and early-stage companies, the University of Hyderabad set up its first incubation centre in 2010 – the Technology Business Incubator (TBI). Presently, the University has three incubation centres viz. TBI supported by DST, Technology Incubation and Development of Entrepreneurship (TIDE) supported by DeITy and BioNEST supported by BIRAC/DBT. As mentioned above, since

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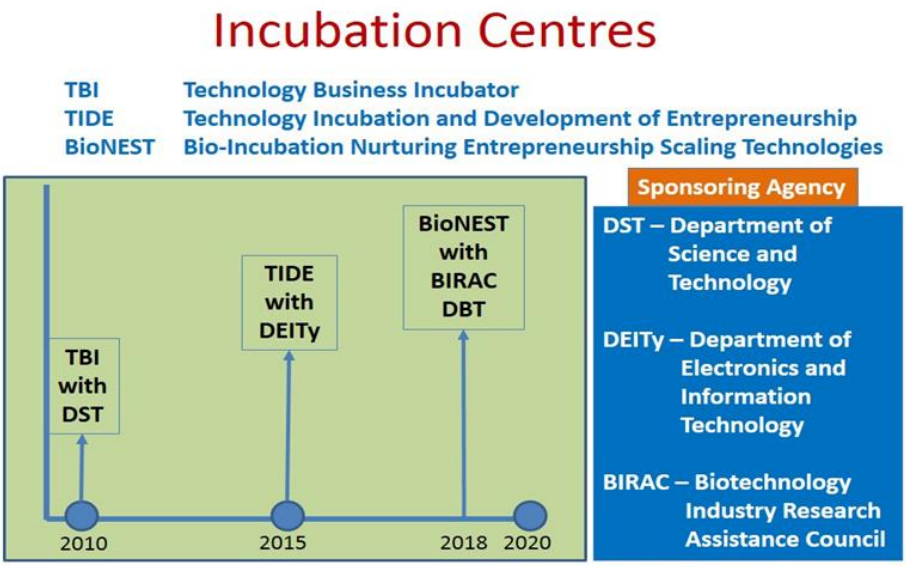
recently the university has brought all incubators and incubation activities under one umbrella through the ASPIRE company.

The three existing incubation centres cover a broad spectrum of areas for work. The TBI, which is supported by the National Science and Technology Development Board (NSTDB) at the Department of Science and Technology (DST), Government of India, focuses on developing innovative technologies in the fields of chemistry, materials, drugs and pharmaceuticals, etc. BioNEST focuses on Life Sciences, Biotechnology, Health Care and allied areas. On the other hand TIDE encourages entrepreneurship in the areas of Electronics, Information Technology and Communications. Through these incubation centres, the University intends to harness the outstanding knowledge potential of its academic environment to create a favourable eco-system for technological innovation.



Further, to promote and encourage entrepreneurship among the faculty of the university, the Executive Council of the University recently approved the "Faculty Entrepreneurship Program" scheme.

In terms of institutional development, the University has recently set up a "Technology, Industrial liaison and Entrepreneurship Unit" (TIE-U) that acts as a knowledge repository, interacts with industry, effects technology transfer, secures IP rights and creates an enabling eco-system for entrepreneurship.

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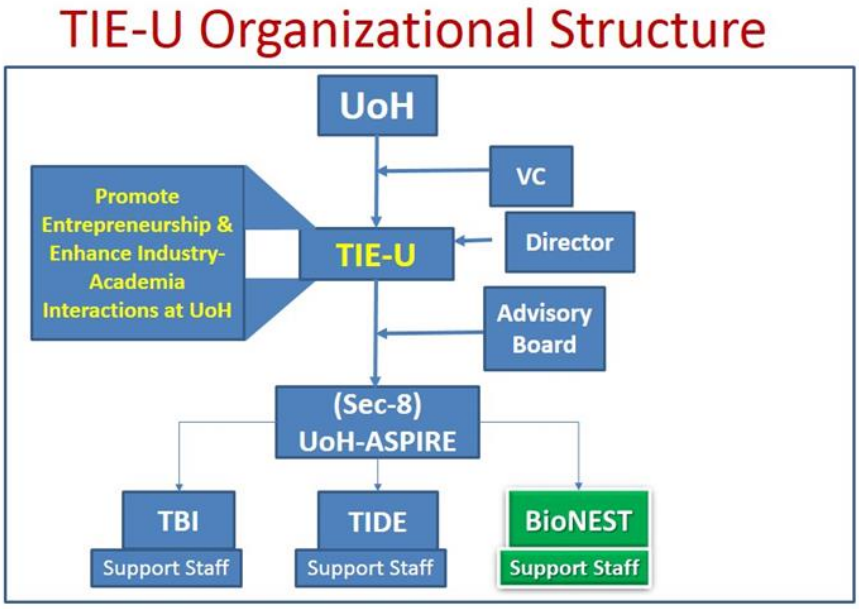

ASPIRE: Association for Scientific Pursuits for Innovative Research Enterprises (ASPIRE)
TBI: Technology Business Incubator
TIDE: Technology Incubation and Development of Entrepreneurship
BioNEST: Bio-Incubation Nurturing Entrepreneurship Scaling Technologies

The University faculty provide consultancy to many IT firms, pharma companies, NGOs and local and national government departments in improving their services and productivity. Interventions by the University have resulted in policy frameworks in the areas of bio-ethics, participatory communication, education and governance both at the local and national level.

- **Formal collaborations with international and national labs and Universities**

The faculty members of University of Hyderabad maintain collaborations with several important international and national academic and research institutes. Some of them are listed below:

- **International collaborations**
  - University of Gottingen, Germany
  - Yale University, USA
  - Cornell University, USA
  - University of Pennsylvania, USA
  - Penn State University, USA
  - Indiana University USA
  - Purdue University, USA
  - Academia Sinica, Taiwan
  - University of Tsukuba, Japan
  - Hebrew University of Jerusalem, Israel
  - University of Münster, 48143 Münster, Germany

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- University of Berlin, Berlin, Germany
- Tel Aviv University, Israel
- Biological Research Center, Hungary
- Okayama University, Japan
- Arizona State University and University of California, Los Angeles, USA
- Savannah State University, USA

- **National collaborations**
  - Nizams Institute of Medical Sciences, Hyderabad
  - ICRISAT, Hyderabad
  - CSIR-Centre for Cellular and Molecular Biology, Hyderabad
  - CSIR-Indian Institute of Chemical Technology, Hyderabad
  - Jawahal Nehru University, New Delhi
  - Indian Institute of Science, Bengaluru
  - Centre for DNA Finger Printing (CDFD), Hyderabad
  - Directorate of Rice Research, Hyderabad
  - National Institute of Plant Genome Research (NIPGR), New Delhi
  - National Institute of Nutrition, Hyderabad
  - Osmania University, Hyderabad
  - CSIR-Institute of Microbial Technology, Chandigarh
  - Apollo Hospitals, Hyderabad
  - National Centre for Biological Sciences, Bengaluru
  - L,V. Prasad Eye Institute, Hyderabad

CURRENT RESEARCH PRIORITIES

University of Hyderabad has filed and/or obtained a number of patents in the Biological sciences, Chemical sciences, Electronics and Material Sciences. All of these areas remain important research priorities. They are listed below.

Physics:

- Solution Grown Organic Crystal N-Benzl-2 Methyl-4 Nitroaniline and a Method of Growing thereof for THz Application
- Sintered In-Situ Titanium Carbide Based Boronized Ceramic Cutting Tool and Method of Making the Same

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- Method for Quantitative Determination of Micro Molar Concentration Level Of D-Glucose Using Surface Enhanced Raman Spectroscopy (SERS) With 2-Thienylboronic Acid as Linker Molecule on Silver Nano-Cluster Substrates'
- Method for quantitative determination of micro Molar Concentration level of d-Glucose using surface enhanced raman Spectroscopy (Sers)With2-Thienylboronicacidaslinker molecule Onsilvernano-Clustersubstrates
- A Process for the Manufacture of Transparent, Large Band Gap, High Refractive Index and High Temperature Stable Titanium Nitride Thin Film for Optical and Optoelectronic Applications
- Non-Stoichiometric Titanium Nitride Films (A Process for Manufacturing Non-Stoichiometric Titanium Nitride Films)
- A Method for Preparing Dielectric Resonators of Arbitrary Shapes
- A process and system for manufacturing stable fibre Bragg gratings
- System and method for generating an optical vector vortex beams having two lobes
- Omnidirectional Antireflection Coating
- A Method for Preparing Dielectric Resonators of Arbitrary Shapes

Life Sciences:

- A process for purification of anti-HIV active glycoprotein (90 KDa) from human placenta.
- A process for purification of A 60 KDa. anti-HIV active glycoprotein from human placenta Indian patent, Patent Filed in 2000, Granted in 2005 (191822, 496/Del/2000).
- Anti-HIV-1 active bacterial and baculovirus recombinant Epap-1
- Nanoparticles of apotransferrin/transferrin pharmaceutical composition containing them and their process for preparation
- Novel nanoparticles of lactoferrin useful for preparing a pharmaceutical composition facilitating easy delivery of the drug and a process for preparing the same.
- Methods and compositions to treat sexually transmitted infections (STIs) and sexually transmitted infections medicated inflammation,
- High active antiretroviral combination drugs loaded lactoferrin nanoparticles for first line and second line

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therapy.

- Novel formulation containing native or recombinant apotranferrin or lactoferrin nanopartcile loaded with biological alone or in combination with chemotherapeutic agent for targeted therapy.
- Novel ant-HIV-1 heteroaromatic compounds targeted to HIV-1 associated Topoisomerase II beta kinase.
- Biopesticide Compositions Comprising Stable Harpinpss-Loaded Chitosan Nanoparticles and Methods Thereof
- Genetically Transformed Microorganism for Biomass Fermentation
- A Method for Preparation of Hybrid Seed Using Targeted Expression of a Cystatin.
- Herbal composition for improving anticancer activity, Anti-inflammatory activity and protecting the body from oxidative damage, and the method of preparing the same
- Development of concrete admixtures with organic components of plants and animal origin
- Butyl Gallate, COX2/5-LOX dual inhibitor

Chemistry:

- Cyclopentanone derivatives for cancer therapy (CYCLOPENTENONE DERIVATIVES HAVING ANTI-TUMOR ACTIVITY)
- Synergistic Pharmaceutical Co-crystals
- Crystalline temozololmide monohydrate and process for preparation thereof
- Stable Cocrystals of Temozolomide
- An Improved Process for the Preparation of Stable Imatinib Mesylate α Form
- Novel Polymorphs and Cocrystals of Curcumin
- Stable and Soluble Amorphous Forms of Olanzapine
- Thermal spin cross-over compounds and methods of using the same
- Fluorescent nanostructure using simple supramolecular self-assembly
- Diaminodicyanoquinodimethane Based Dyes for Bioimaging

Engineering and technology:

- A novel abrasive free chemical mechanical planarization (AFCMP) of non-polar and semi polar iii-V Nitride Surfaces

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- Colossal Piezoelectric Response in Sol-Gel Derived Barium Calcium Zirconium Titanate Ceramics
- A Process of Manufacturing Barium Zinc Tantalate Ceramics for Microwave Applications
- A Process for the Manufacture of Transparent, Large Band Gap, High Refractive Index And High Temperature Stable Titanium Nitride Thin Film for Optical and Optoelectronic Applications
- Non-Stoichiometric Titanium Nitride Films (A Process for Manufacturing Non-Stoichiometric Titanium Nitride Films)
- A Method for Preparing Dielectric Resonators of Arbitary Shapes
- A Sintered In-Situ Titanium Diboride Ceramic Cutting Tool and Method of Making The Same
- Synthesis of Biocompatible Hollow Zinc Phosphate Nanocapsules Using Plant Virus (Cpmv)
- Development of Hollow Nanoporous Yolk Shell Nanocapsules from Neem Seed thereof
- Preparation and Design of a Unique Nano Porous Polymeric Capsules of [(Meopegnh)B(Lglua)]PCLW
- Stable Up- Conversion Nanoparticle Dendrimer (Ucnd) & Method of Making thereof
- Stable Up-Conversion Nanoparticle Super Lattice (Ucn-Sl) & In-Situ Process for Developing thereof
- Up- Conversion Nanoparticle Dot (Ucn – Dot) of Size 3.5 Nm & its Preparation Process Thereof
- Poly-N-Acryloyl L-Leucine Methyl Ester Hollow Nanocapsules (Plme) for Drug Delivery & Antibacterial Properties: Method of Fabrication and Uses.

EXISTING CENTRES OF EXCELLENCE THAT WILL BE PRIORITIZED IN RESEARCH AND EDUCATION

The University has several specialized centres of research that pursue specific research priorities

- **Centre for Nanotechnology**

The University set up a Centre for Nanotechnology (CFN) in 2007 with funding from the Department of Science and Technology. More than thirty five faculty members belonging to the Schools of Chemistry, Physics and Life Sciences, with considerable reputation in the national and international scene of science, have participated in the activities of this centre. Such a large collaborative effort has made it possible for the investigators to carry out research in some of the very important problem areas in nanoscience and nanotechnology from the chemical, physical and biological angles. The Centre has adopted a symbiotic and

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synergetic approach to clearly defined, technologically relevant and multi-disciplinary issues. The CFN has aimed at developing models, techniques, processes, products and technologies in the following areas:

- Metallic, Inorganic and Organic Materials
- Biological Materials
- Sensors, Devices and Diagnostic Tools – Inorganic
- Sensors, Devices and Diagnostic Tools and Microarray Technology – Biological
- Drug Delivery and Gene Therapy

- **Centre for advanced studies in Electronics Science and Technology (CASEST)**

The Centre for Advanced Studies in Electronics Science and Technology (CASEST) was established in 2014. It is the successor of the Electronics Program established at the School of Physics in 1995 at the initiative of the University Grants Commission and the (then) Department of Electronics to promote research and teaching in electronic device research. The teaching programs are reviewed every 5 years and have evolved from M.Sc. (electronics) (2-year) to M.Sc. (Tech.) (3-year) to the present 2-year M.Tech. in Integrated Circuit Technology. Research-grade facilities have been established by the faculty for high quality R&D activities in Electronics Science. M.Tech. (Integrated Circuit Technology) and the Ph.D. (Electronics Science) programs were launched in 2004. The Centre has research interests in Design, Simulation, Fabrication and Testing of Digital and RF circuits, Functional Materials, Devices and Processes.

- **Advanced Centre of Research in High Energy Materials (ACRHEM)**

ACRHEM is an Advanced Centre of Research in High Energy Materials at the University of Hyderabad that is supported by the Defence Research and Development Organization (DRDO). This is the first Centre of its kind created at the initiative of DRDO in an academic institution. The objective of the Centre is to advance the study and research of sciences pertinent to High Energy Materials. The ACRHEM is an interdisciplinary research effort working towards understanding of the theoretical and experimental aspects in the areas of Physics, Chemistry, Mathematics & Statistics of Processes, Photonics/Electronics instrumentation involved in High Energy Materials. ACRHEM has state-of-the-art research facilities and techniques for perceiving the properties of high energy materials (HEMs) through experiments with lasers, theoretical calculations and modelling, synthesis of novel HEMs and nano-energetics. ACRHEM also aims at quality teaching with student-faculty ratio that is highly conducive to individual attention.

- **Centre for Digital Learning Studies and Resources**

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The Centre was set up in 2016 under the Online Education Policy (OEP) of the University. University of Hyderabad is the first University in the country which has adopted such a policy. The Centre is intended to develop skills-based and entrepreneurship-oriented online courses in various disciplines with the help of national and international collaborations. It has also plans to offer courses in different educational areas across the globe. In order to maintain quality of the e-content, the Centre regularly organises workshops for the faculty in emerging technologies, such as games and gamification, Artificial Intelligence, Virtual Realities, etc. The Centre has been conducting conferences in innovative and newly emerging areas like University Social Responsibility, Academic Diplomacy, Quality Assurance, etc. The Centre undertakes research projects involving students along with faculty.

RESEARCH AND EDUCATION PRIORITIES FOR THE FUTURE DEVELOPMENT OF THE UNIVERSITY

Research areas

- Remote Functionalized Diaminodicyanoquinodimethanes Having Enhanced Fluorescence in the Solid State (at proof-of-concept stage)**:** The fluorescence emission of most dye molecules is quenched when the molecules aggregate or form solids. Diaminodicyanoquinodimethanes (DADQs) exhibiting significant enhancement of fluorescence emission in the solid state over the solution state are developed. Six new derivatives of DADQ were synthesized and fully characterized. Fluorescence of these molecules can also be switched reversibly between low and high values in doped polymer films in the presence and absence of solvent (chloroform) vapors. Polymers such as poly(vinyl alcohol) and poly(styrene sulfonate) were used. These materials are potentially useful in imaging, display and sensor applications. Some imaging applications are currently being investigated, and preliminary findings are submitted for a new patent application.
- Tunable microwave devices (currently at proof-of-concept stage): At high frequencies making electronic circuits tunable is difficult but required. It is achieved with semiconductor varactors but they become lossy at higher frequencies. An alternate is to use ferroelectric thin film based capacitors. They exhibit a voltage dependent capacitance and hence can be used as a varactor which gives moderate loss even at higher frequencies. Such varactors are developed with inter digitated electrodes and as parallel plate capacitors. Using these capacitors the circuits developed include tunable filters, phase shifters and matching circuits. They are important for the strategic sector for electronic warfare, phased array antenna and electronic beam form forming. Other major application is in the evolving communication scenario

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including 5G. These devices are to be fabricated along with other integrated circuits but they do require only limited fab facilities. They are at proof of concept level and can be developed further with an industrial partner.

- High Q resonators using piezoelectric thin films (currently at proof-of-concept stage): FBAR (film bulk acoustic resonators) are well known for higher frequency applications. A similar resonator is HBAR (high overtone bulk acoustic resonators). We have developed them with a Q value of 23,000 at about 2.3 GHz. Such resonators are needed in communication circuits for frequency selection as well as for developing sensing applications.
- High temperature electro acoustic sensors: We have so far developed piezoelectric thin films that work at higher temperatures of about 600C. On them the above mentioned circuits are being fabricated which can be used as sensors to work at higher temperatures. They are required in mining, nuclear reactors, engine diagnostics etc. that operate at higher temperatures.
- Microwave dielectric resonators (currently at proof-of-concept stage): Different compositions suitable for this application have been developed and demonstrated. To shape them in different geometries, a gel casting technique suitable for them is also developed and demonstrated.
- Nanoparticle based drug delivery systems for preventing HIV infection (currently at proof-of-concept stage): Developed a protein nanoparticle based drug delivery systems using apotransferrin and lactoferrin as delivery vehicles. This technology is very novel as the process retains native state of protein as well as drug. In these nanoparticles both hydrophobic (curcumin, paclitaxel etc.) as well as hydrophilic drugs (doxorubicin, 5 fluorouracil, etc.) as well as metal compounds carboplatin, oxaliplatin, can be loaded
- Non-stoichiometric Titanium Nitride films (currently at the stage of ready prototype): The application relates to a process for the manufacture of transparent, large band gap, high refractive index and high temperature stable, non-stoichiometric titanium nitride thin film (TiN $0.1<x<1.0$) for optical and optoelectronic devices comprising the steps of preparing the said film by magnetron Sputtering in a mixture of argon and nitrogen atmosphere, as a thin layer on a Substrate selected from stainless steel, amorphous fused silica, magnesium oxide, lanthanum aluminate and Sodium borosilicate glass, the deposition of the said layer of the substrate being carried out at temperature between ambient and 873 K, the deposition being controlled by varying the nitrogen pressure. The invention also provides films

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prepared by this process and Substrates coated with such films. Process optimization has been carried out lab scale. Scale up is being investigated. There are many claims, but the interesting one is that the non-stoichiometric titanium nitride thin film so formed has an optical transmission greater than 80%, and the non-stoichiometric titanium nitride thin film is formed in different colors selected from brown, blue, magenta, and yellow. If the films can be deposited on plastics and complex shapes it will have a great impact on the decorative coatings industry. Examples of application are mobile phone covers, bottles, door handles, etc.

- Lab Chip Prototype for IEEE 802.11ac WLAN (currently at the stage of ready prototype): This is the first dual-band sub-sampling receiver front-end with sampling frequency optimization to meet the ultimate receiver EVM of −40 dB over wide input power range of 19 dB. A systematic sub-sampling receiver chain EVM optimization with respect to major system-level impairments such as noise folding, sampling frequency, IQ mismatches, phase noise of the sub-sampling clock and unit capacitor value realizable at the decimation filter is available. The dual-band sub-sampling receiver has a 26 dB to 40 dB continuously tunable gain for both the 2.4 GHz and 5 GHz WLAN bands. Continuously tunable gain ensures the ultimate receiver EVM performance over wider input power levels. In addition, the 5 GHz band is continuously tunable from 4.7 GHz to 5.7 GHz. Active balun feedback LNA followed by a subsampling down-conversion mixer is implemented to down-convert both WLAN bands to an intermediate frequency in the range from 445 MHz to 538 MHz. Sub-sampling frequency optimization, down-converts both WLAN bands with the sampling frequency clock from 1.78 GHz to 2.15 GHz to reach the target EVM. Additionally, a switched capacitor decimation filter running at 90 MHz is implemented to provide dual functionality of down-conversion to baseband and band selection. A test chip is available in 1.2 V 65-nm CMOS technology. The dual-band sub-sampling receiver occupies a total active area of 0.72 mm2 and consumes a total power dissipation of 61 mW. The overall receiver chain shows a noise figure of 11.5 dB at the highest gain and an IIP3 of −8 dBm at the lowest gain.

POTENTIAL EXPANSION OF EXISTING RESEARCH CENTRES

The Life Sciences, Chemistry and Physics departments have a network of national and international institutions that are involved in cutting-edge research in areas such as defence, immunity of crops, cancer drug research, ageing, polymers and nano-technology, etc. Future expansion of research is expected on the basis of collaboration within the existing networks. The Centre for Digital Learning Studies and Resources can be

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expected to expand its research on the impact of digital learning on social, economic, cultural and linguistic developments in India. For this expansion it will rely on the national and international network that it has already created.

With additional funding from the government of India and the private sector, the university plans to set up research centres in the areas of Space and Earth Sciences, Environmental Sciences and Genomic Studies.

The university is in the process of finalising agreements with many government departments and the private sector for emerging collaborations. Over the years, the university has created excellent research facilities that would make a difference in this process. The research activities generate significant amount of knowledge base results, including patents.

The University can establish a Technology Enabling Centre with the help of DST in order to interact with industry. The centre will cater to the diverse needs of university in multi-disciplinary areas, such as Biotech, Pharma, Renewable Energy, Electronics, Nanotechnology and Internet of Things (IoT). Indeed, University of Hyderabad has initiated collaboration with Technology Entrepreneur Zone (http://tez.co.in/) for establishing such a Technology Enabling Centre. The Entrepreneur Zone (TEZ) is a Start-up Accelerator, Entrepreneurship Training and Incubation Centre located in University of Hyderabad, India, for business start-ups. It functions like a boot camp and is a unit of Zen SkillProc Pvt. Ltd., a company specializing in skills development. Its training/incubation curriculum not only intends to assist prospective start-ups but is also helpful for those especially spouses and children who want to join/succeed family businesses.

Spread over 2000 acres of land, UoH is located in the midst of the high-tech city, the most fast developing place not only in Hyderabad but also in the country. Hyderabad is home of many knowledge intensive sectors. For example, the high-tech city hosts over 2000 IT, ITeS companies constantly looking for new areas for diversification and investment. Hyderabad is also known as the drug capital of India. It houses several leading drugs and pharmaceuticals manufacturers and exporters to several countries. These companies are on constant prowl for new knowledge to expand their activities. Similarly, the Genome valley located in Hyderabad is the single largest biotech cluster, not only in India but also perhaps in Asia. The valley houses over 200 biotech companies at a single location. A large number of vaccine manufacturers are located here and export significant part of the vaccines to the world. The city hosts a number of leading R&D and academic centres of excellence such as CCMB, CDFD, NIAB, IICT, TIFR Centre, IIIT, ISB, IITH and NIN with whom UoH has excellent relations. Therefore, UoH forms the ideal centre for establishing the planned Technology Enabling Centre.

The Technology Enabling Centre in the above said fields will both (a)

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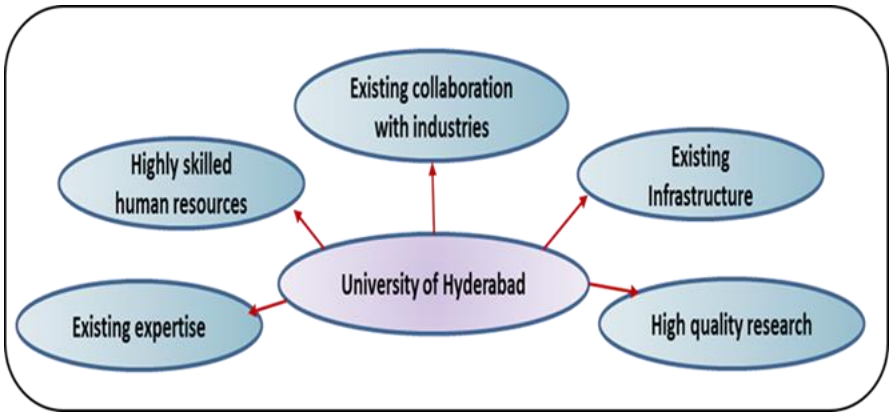
Strengthen and expand the incubation services and related entrepreneurship initiatives at UoH and in Hyderabad and (b) provide enabling environment for the industry in and around Hyderabad to explore the novel discoveries and innovative technologies developed by UoH faculty and start-up ventures placed in various incubators of the UoH campus and outside. It will help UoH to grow into a cutting-edge Science Technology University that engages students, researchers, faculty and others in the region.

The Technology Enabling Centre - UoH is expected to be a collaborative activity between a team of highly qualified researchers in the institution and researchers or research-users in companies or organizations in and around Hyderabad. In case the nature of research is related to production or improvement of public goods, collaboration may include appropriate public agencies. The proposed Technology Enabling Centre - UoH will focus on exploring the new and emerging technologies, multidisciplinary and translational research in the areas of Biotechnology, Pharma, Renewable Energy, Electronics, Nanotechnology and Internet of Things. University of Hyderabad, being a research-focused University that undertakes projects in cutting-edge areas with funding from national and international agencies, would provide the necessary intellectual climate and drive the faculty, scholars and students towards innovation and entrepreneurship.



UoH has been instrumental in providing support for the successful start-up ventures at its UoH-TBI and UoH-TIDE with the help expertise and infrastructure of already existing in the University. However, the intellectual and resource potential of UoH still largely remains underutilized in developing and harnessing potential innovations for commercialization and for benefit of the Indian society; especially the following areas need immediate attention: biotechnology, pharma, green energy, electronics, material science and nano-technology.

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University priorities for research and innovation targeted at inclusive economic growth

RESEARCH PRIORITIES TARGETED AT INCLUSIVE ECONOMIC GROWTH

The university's regular interaction with the civil society and public and private institutions ensures that students, research scholars and faculty members are acutely aware of the realities faced by the society. Inter-disciplinary research involving different school is in the process of addressing issues such as environmental pollution, inclusion of disadvantaged persons in the private sector, gender equality in informal workplaces, and access to government schemes and programmes.

Much of the current research at the University, especially in the areas of the Live Sciences, is relevant to inclusive economic growth and sustainable development, not just to industry. The effects are difficult to disentangle. However, there are several research priorities that are particularly relevant to inclusive economic growth.

The research priorities targeted at inclusive economic growth

- Digital Learning Studies
- Information Ethics and Digital wellness
- Digital Humanities
- Bio-informatics and Bio-ethics
- Hospital Management
- Optometry
- Pharma
- Renewable Energy, etc.

POTENTIAL EXPANSION OF EXISTING RESEARCH CENTRES AND OPENING OF NEW CENTRES

The University can benefit from the expansion of the following centres that work on issues relevant to inclusive economic growth and sustainable development

- Centre for Digital Learning Studies, Training and Resources
- Centre for High Energy Materials
- Centre for Cognitive Studies
- Hospital Management
- Centre for Earth and Space Sciences, etc.

The design and establishment of the following new research centres will be able to strengthen the research and innovation output of University of Hyderabad in areas related to social issues, inclusive economic growth and sustainable development

- Centre for Digital Humanities
- Centre for Information Ethics

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POTENTIAL EXPANSION OF COLLABORATIONS OR CREATION OF NEW COLLABORATIONS

In order to improve its research and innovation output in areas relevant to social issues and sustainable development, the University should strengthen collaboration with various stakeholders, especially as regards inclusive innovation (innovations accessible to disadvantaged people and poor sections of the society). Among the priority stakeholders with whom collaborative options should be explored are:

- Pharma industries
- Chemical industries
- Software Companies
- Truth Labs, etc.

POTENTIAL EXPANSION OF INTERNATIONAL COLLABORATIONS OR CREATION OF NEW INTERNATIONAL COLLABORATIONS

The following research and academic collaborations should be expanded in order to improve research and innovation on social issues:

- Collaborations with research institutions in the ASEAN region
- Collaborations with research institutions in the BRICS region
- Collaboration with Asia University, Taiwan
- Collaboration with Duke University, USA
- Collaboration with Ohio State University, USA
- Collaboration with University of East Anglia, UK, etc.

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University priorities for research and innovation targeted at pressing challenges facing societies in Southern and Southeast Asia

CURRENT AREAS OF TEACHING AND RESEARCH

The university's research and outreach work mostly involves SAARC member countries and South East Asian Countries.

As part of its outreach programme, the University of Hyderabad, in collaboration with the South East Asian Countries, has been conducting bi-annual conferences since 2010 on society, culture and language in the Asian context. Each bi-annual event has its own theme; for example, the conference conducted in Hue University, Vietnam in 2018 has focussed on Sustainability and Inclusiveness of Asian Societies. The conference conducted in 2012 came up with recommendations on protecting and promoting Asian languages and cultures that was submitted to UNESCO. In all of these conferences, the emphasis was on environmental, public health and related issues in Asia.

The e-Learning Centre of University of Hyderabad was one of the initiators in conducting the Information for All Programme-BRICS Conference in 2018. One of the outcomes of the conference is to form an international consortium for developing online courses on information ethics, digital wellness, etc. The e-Learning Centre is the leader of the Consortium.

The University currently excels in the following research areas relevant to the challenges facing societies in Southern and Southeast Asia:

- Natural language processing and machine translation
- Biotechnology and bio-informatics
- Genome research
- Diaspora studies
- High energy materials
- Optometry
- Cancer drug research, etc.

PRIORITY FUTURE RESEARCH AREAS RELEVANT TO THE PRESSING CHALLENGES FACING SOCIETIES IN SOUTHERN AND SOUTHEAST ASIA

- Digital learning studies
- Biotechnology
- High energy materials
- Nano materials
- Advanced steels
- Optometry
- Waste water treatment
- Drug delivery and gene therapy, etc.

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POTENTIAL EXPANSION OF RESEARCH CENTRES

Potential expansion of the following existing research centres should be considered in order to expand the research and innovation output relevant to the pressing challenges facing societies in Southern and Southeast Asia:

- Centre for Digital learning studies, training and research
- Centre for advanced studies in electronic science and technology
- Advanced Centre of Research in High energy Materials

The following research centres may be opened in the future:

- Centre for Digital Humanities
- Centre for Information Ethics.

POTENTIAL EXPANSION OF COLLABORATIONS

The university's research agenda and output in the above areas will benefit from expanding the existing cooperation with Moodle company, Unity 3D, ICICI Knowledge Park, Bharatiya Sanchar Nigam Limited (BSNL), Truth Labs, Lenskart, etc.

The University will also benefit from expanding cooperation in these research areas with other academic institutions, such as: University of Alberta, International Institute of Information Ethics (Canada), University of Pretoria (South Africa), Asia University (Taiwan), University of East Anglia (UK), etc.

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Areas of innovation and research activities in which students should be involved

The university is making efforts to increase the involvement of Integrated Masters programme and post-graduate students in areas of emerging relevance. However, a massive fund crunch is affecting the university's plans. The university is seeking alumni support in this regard. It is hoped that with the recently accorded autonomy to the university, the government will increase its support to such institutions.

Students can in principle be involved in applied research in virtually all areas, as well as in areas related to education outreach, provided that they have the competencies and the qualifications for this. However, involvement has to be structured through a dedicated university support structure and the process should be managed and supervised by faculty. The role of students has to be carefully defined and should concern elements of an applied research project that are suited to the students' level of knowledge and skill. Undoubtedly, there is scope for involving students in consultancy-related activities for business, such as market research or product design. There is a much more limited opportunity for students to get involved in basic and blue-sky research.

The INNOTAL project provides an excellent opportunity to create and initiate the work of a Student Innovation Lab tasked with creating clear rules and procedures for the implementation of focused innovation projects. These projects are expected to be a mixture of research and consultancy. They will involve external stakeholders who will be invited to formulate real-world market challenges derived from their work, and engaging students in finding solutions is essentially a form of providing consultancy. It is imperative, however, that such projects are clearly linked to education and that they reinforce results and skills achieved through teaching. A dedicated university structure will actively seek to link external stakeholders interested in consultancy projects to promising student talent and will also work to create a feedback loop that would allow the results from these projects to be incorporated in teaching in view of making it more relevant to the society.

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