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UNIVERSITY PRIORITY SETTING REPORT FOR THE PROVISION OF RESEARCH AND EDUCATION

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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

This report will seek to chart the priorities that will lead to achieving the following specific objectives:

- To provide opportunities for rural populations with special emphasis upon women, socially disadvantaged and differently abled groups, allowing them to achieve academic excellence and employability.
- To strengthen the already established fusion between academics and industry, with the ultimate aim to identify the gaps and accordingly, design courses to impart skill-based education as per the requirements of the region so as to improve employability and develop entrepreneurial capabilities.
- To nurture innovative ideas shaping into products facilitating spinoffs and creating awareness to protect intellectual property (IP).
- To impart value added, culturally rich education by adopting the local-to-global approach.
- To ensure good Governance inculcating accountability based on self-evaluation amongst the stakeholders of the University.

NATIONAL PRIORITIES FOR RESEARCH, INNOVATION AND EDUCATION REFLECTED IN BAMU'S RESEARCH AND EDUCATION AGENDA

"Make in India", "Creation of Talent pool", "Employability skill development", "Applied research and education" are some of the current priorities in the research and education policy of the national government.

The Indian government has adopted the "Make in India" policy so as to invite more of the creative brains not only from within the country but also from the entire globe to convert the country into a manufacturing lab. This endeavour requires the "creation of Talent Pool' which is also prioritized. Further, in order to promote skill development resulting in employability, the Indian Government is stressing upon and directing all institutions imparting higher education to add components of skill education in each and every course. Moreover, applied research is given more credence in education considering the societal requirements. In this regard, our University has received funding from University Grants Commission to establish Deen Dayal Upadhaya Kaushal Kendra wherein 2 skill-based Programs i.e., B. Voc and M. Voc (Automobiles) have been initiated. Several such other Programs are in the pipeline.

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

RESEARCH AND EDUCATION AREAS RELEVANT TO THE ECONOMY AND BUSINESS ENTERPRISES IN WHICH THE UNIVERSITY CURRENTLY EXCELS

The University provides education in 52 academic Departments that are completely ICT-enabled for research-directed training. The objective of the university is to build strong ICT skills and research skills of students during their studies. The current educational priorities are related to the currently existing Schools and Study Centres of the University:

- **School of Computational & Physical Sciences**

The Department of Computer Science & Information Technology was established in 1994. It was the first Department to get equipped with internet facility. At a later stage, it assisted all the University Departments to set up the same. The Department seeks to ensure adequate infrastructure and facilities so as to ensure high standard of education and research. The Department avails of Augmented Human Computer Interaction Lab (Speech Analysis and Interactive System), a Geospatial Technology Research Lab, System Communication and Machine Learning Lab (Communication with system using EEG Speech),a Multimodal Biometric Research Lab (biometric and multibiometrics), a Multispectral Research Lab (Multispectral Image and Signal Processing), a Data Analytics Research Lab (Big Data Analytics), a Biomedical Image Processing Lab, a Vision and Intelligent System Lab (focused on machine cognition and interactive computer systems - Computer Vision, Pattern Recognition, Video Surveillance, Audio-Visual Speech Recognition Interactive Intelligent System, IoT, Facial Expression Mining and Optical Character Recognition), a Computer Vision Lab (Computer Vision and Pattern Recognition), Advance Computing Lab (Image Processing, Pattern Recognition and Intelligent System), a Computational & Psycho – Linguistic Research Lab (Research under Natural Language Processing and Document Processing).

In terms of research, among the following major Projects that are being implemented or are in the pipeline, are:

- UGC CPEPA (Centre of Potential Excellence in Particular Area): "Centre of Excellence in Geo-Informatics Science", applied for financial Assistance of Rs. 99.3 Millions
- Establishment of Reconfigurable Lab in association with IIT Powai and State Government of Maharashtra of Rs. 80.0 Millions (Awaited for Release of Grants)
- Proposal with DIETy (Department of Electronics and IT, Government of India) in association with NIELIT Aurangabad
- Collaborative Research Program with NIO (National Institute of Oceanography).
- Research Projects under Bio-Medical Image Processing, Human Computer Interactions, System Communication and Machine Learning and Computational psycholinguistics.

The Department of Physics was established in 1965. It is one of the

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few Departments in the University to offer a reprographic facility. The Department has signed MoUs with foreign universities in California (US), Australia, Korea and Japan. It has also cooperated with premier institutes in India like BARC, TIFR, NSC, SAMEER, MATSCIENCE.

The Department's laboratories are equipped with precision instruments (storage oscilloscopes, microprocessors, microcontrollers, sensor system, optoelectronics Kits, microwave benches, microwave components, high precision multimeters, power supplies, function generators, LASERs, counter-detectors for nuclear particles, multichannel analyzers, educational kits for measurement of electrical conductivity, specific heat, magnetic properties, photoconductivity, etc.). This allows the faculty and students to engage in indigenously developed concept-oriented experiments as well as experiments developed by leading scholars in the field of Physics.

All in all, the Department maintains 16 research laboratories, which also reflect the current educational and research priorities:

- Thin Film and Nanotechnology Research Laboratory (semiconductor materials, Photo sensor, Gas Sensor applications, Photovoltaics)
- Sample Preparation and Material Research Laboratory
- Mossbauer Research Laboratory
- Magnetic Material Research laboratory
- Thin Film Research Laboratory (Ferrite Material, Gas Sensor application)
- Dielectric Research Laboratory (Microwaves Interaction with Matter, Time Domain Spectroscopy)
- Intelligent Material Research Laboratory - Nanoscale Material
- Intelligent Material Research Laboratory - Sensor and Optoelectronics
- Intelligent Material Research Laboratory - Clean Room (Synthesis and Characterization nanostructured materials for Sensors, NLO materials Crystals)
- Intelligent Material Research Laboratory - Sophisticated Analytical Research Laboratory (Synthesis and Characterization nanostructured materials for Sensors, NLO materials Crystals)
- Microwaves and Soil Physics
- Spectroscopy and Fractals Research Laboratory (Spectroscopy, Gas Laser fabrication and dye lasers, High speed high voltage pulse techniques, Mathematical Physics, Liquid dielectric studies, Laser Spectroscopy, Awareness of Computer software (Mathamatica, MathCAD, FORTRAN

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77,Turbo Basic, Visual Basic etc.), Python, IPython, C++, Scilab Other Interests: Mathematical Physics, Numerical Methods, Computer Interfacing)

- Advanced Material Research Laboratory (Synthesis and Characterization of Nanomaterials for Solar Cells)
- SDD (X-ray Spectroscopy (EXAFS and XANES), Condensed Matter Physics)
- Molecular Interaction Research Laboratory (Microwave Interaction with Matter, Time Domain Reflectometry, Dielectric Spectroscopy)
- Nuclear Physics Research Laboratory (Nuclear Physics, Gamma ray interaction studies of biomolecules).

The Department of Chemistry was established in 1958. It maintains collaborative relations with local Pharma Industries like Wockhard Ltd., Orchid Pharma and Fine Chemicals, NCL Pune, I.I.T and B.A.R.C. Mumbai. The Department pursues its education and research priorities with the help of two Instrumentation Laboratories and five Research Laboratories.

Research projects are currently underway in the following research areas:

- Nanotechnology
- Nanomaterials for Energy Conversion, Electrochemical sensors, Environmental electrochemistry.
- Heterogeneous catalysis, Natural and synthetic zeolites, Mixed metal oxides
- Macrocyclic Ligand Coordination Chemistry

The Department of Nanotechnology was established in 2010 to allow BAMU to expand its educational and research work in this emerging and fast developing discipline. The Department cooperates with premier Institutes in India like C-MET, BARC, TIFR, IUAC, UGC, DAE, CSR, DST, DRDO, BRNS, CSIR, SAMEER, MATSCIENCE etc., and with international Institutes like Hanyang University (Seoul, Korea), National Tsing Hua University (Hsinchu, Taiwan), National Taiwan University (Taipei, Taiwan). The Department is still in its formative stage and offers M.Sc. and Ph.D. programs. It already has basic facilities necessary for the study and research in nano technology - deposition technique of thin film & growing nanoparticles, thermal vacuum evaporation unit, electro deposition, chemical bath deposition, selective ion layer adsorption and reaction technique, vacuum annealing furnace, gas Sensing unit, solar cell fabrication and characterisation system, photo electro chemical cell, UV-VIS spectro photo meter, thermo electric power measurement, X-ray diffraction (PAN Analytical), scanning electron microscopy with EDAX (JEOL).

The Department of Statistics offers M.A./M.Sc. and Ph.D. in Statistics subjects. It has a well-equipped computer laboratory and the

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most advanced and job-oriented software like SPSS-21, MINITAB-16 and SYSTAT-13. The department focuses on the following research areas:

- Operations Research
- Design and Analysis of Experiments
- Actuarial Statistics

The Department of Electronics offers a student-centered collaborative curriculum that addresses the critical need for employees in the cutting-edge economic sectors related to electronics and digital technology. The Department avails of basic equipment necessary for high-quality education in the field. Current research priorities include:

- Sensors (Gas phase, liquid phase, bio elements)
- Solid State Devices (Silicon alternatives, heterostructures, organic
- Electronics, flexible electronics
- Instrumentation (Bottom Up integration)
- Industry solutions

The Department of Environmental Science was established in 1985 and offers M.Sc and Ph.D degree in Environmental Science. The major domains of research activities are in the areas of Environmental monitoring, Environmental Management, Water Pollution, Waste Water Treatment, Solid and Hazardous waste Management. Students of the department obtain field experience in areas related to Ecology, Biodiversity, Environmental Legislation, Industrial Pollution Control, Environmental Statistics, Energy Resources, Environmental Chemistry, Environmental Microbiology and Biotechnology, Disaster Management, Management, Water and Wastewater treatment technology, Air Pollution Control Technology, Industrial Safety, EIA, CDM, Sustainable Development, Solid & Hazardous Waste Management, Remote Sensing & GIS etc.

The department is also running Environmental Consultancy laboratory and extending consultancy services to various industries and institutions. Services are offered in various sectors, including Drinking water, Packaged water, Waste water, Industrial effluents analysis, trace metal analysis, Microbial analysis for portability, Ambient air quality monitoring, Ecology and Biodiversity studies, Work place monitoring, Soil and sludge analysis, MSW/ hazardous waste analysis, Eco-toxicology studies, Treatability and feasibility studies, Consultancy services for environmental laboratory set-up, In-plant training for educational institutes, environmental professionals and company executives, Development of Environmental cell for Municipal corporation.

The Department receives the support of various funding agencies like UGC, MoEF, DST, DBT, ICSSR, CSIR. It also cooperates with

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research organisations like B.A.R.C., Government of Maharashtra etc.

The Department of Environmental Science is actively involved in research activities on various important environmental issues such as water, air, soil, and noise pollution. Pollution studies in and in the vicinity of Aurangabad, Marathwada and other parts of India were carried out. Special attention has been given to the study the solid waste related issues along with sustainable developmental issues and industrial environmental problems. Industrial waste water treatment and sewage related research work is being carried out. Past research included a resource studies on wild life, forest, and energy resource.

The Department of Bio-chemistry was established in 1992. It operates an exclusive Laboratory that is not available elsewhere in India - the Plant Pest Interaction Laboratory. The department also has an Animal House Facility for conducting animal experiments. The department currently implements a large number of research projects on proteomics bioinformatics. It also collaborates with Oklahoma State University (USA) on doing research on stress tolerance in plants.

- **School of Professional Studies**

The Department of Mass Communication and Journalism was established in 1973 and provides qualified staff for the media sector. It trains journalists for work in local, regional and state-level newspapers and TV Channels. Recent projects include "Digital studio" and "Numero– Uno" for launching Media Web Channel - a multi-media web platform for global media students.

The Department of Chemical Technology was established in 1994. It works in close collaboration with the Pharmaceutical Industry and Food Technology industries, for which it prepares skilled personnel. The Department has laboratories on advanced technological models. It also cooperates with Shreya Life Sciences and National Institute of Jammu, IIM. It is one of the Departments with a high number of research projects.

The Department of Tourism Administration was established in 1994 and boasts 50% practical orientation of the study programs. The Department is a significant tourism management skills provider in the State of Maharashtra and it work is crucial to the tourism and travel industry in the region. Although its focus is on education, it has also presently undertaken several major research projects. Since 2010 this Department has operated a Research & Consultancy Cell. Initially, the faculty members at the department were actively involved in the assignments with Tata Consultancy Services (TCS), Oriental Consultants Japan, and Ministry of Tourism Government of India through the Indian Institute of Travel and Tourism Management (IITTM) Gwalior and Maharashtra Tourism Development Corporation Ltd (MTDC). Currently, many more research project are underway. The main research areas are:

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- Marketing
- CSR
- Socio-Economic Impacts
- Heritage Tourism Management Tourism Development
- Tourism Planning
- Tourist Police.

The Department has also implemented a Tourism Awareness Campaign in 35 villages in the vicinity of the tourist destinations in the Aurangabad district. To this end, staff, researchers & students have been trained to manage relations with local stakeholders.

The Department of Management Science has existed as a separate department since 2007. It serves the need of local and regional business for qualified managerial personnel. The department has a separate Placement Cell that organizes placement for in-plant training in local and regional industries. The priorities for research and education include:

- Industrial research
- General Management Marketing
- H.R.
- IT and entrepreneurship research.

The Department of Printing Technology has existed since 2009. It is unique for the region in that it offers technical training in printing and is 100% industry oriented. The Department maintains a Prepress Laboratory and a Screen Printing Laboratory.

The Department of Commerce has been established in 1968. It has excellent cooperation with industry, especially the banking sector, and supports student placement. The Department engages in research projects on the socio-economic development of the Maharashtra state.

RELEVANT RESEARCH AND EDUCATION CENTERS

Deen Dayal Upadhyay KAUSHAL Kendra imparts skill-based education to enhance youth employability through technically empowering. This Center was established in 2013. In order to minimize the gap between the occupational demands of industries and methodical classroom teaching, this Centre allows experts from industry and stalwart academicians from the University periphery to work together to deliver innovative technical education. The Centre offers:

- B.Voc. (Industrial Automation)
- B.Voc. (Automobile)
- M.Voc.(Industrial Automation)
- M.Voc. (Automobile Technology).

This center has concluded a number of Academic and Industrial MOU.

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Among its collaborators are 40 leading companies from the region. Examples of industrial partners are:

- Endress + Hauser, Aurangabad M-171/176, Waluj Industrial Area, MIDC, Aurangabad
- NAC Group Of Industries, Aurangabad
- Bajaj Auto Ltd, Aurangabad
- Krish Automation, Aurangabad
- Skoda Auto India Pvt Ltd
- Luans Electronics, Aurangabad
- Siemens Ltd, Aurangabad
- Endurance Technologies Pvt Ltd., Aurangabad
- Scientech Technologies Pvt. Ltd., Indore
- Electromates Robotics And Automation Pvt. Ltd., Aurangabad
- Marathwada Auto Cluster, Aurangabad
- NHK Automotive Component India, Aurangabad

RUSA - Centre for Advanced Sensor Technology

This Center focuses on identification of new technologies in the area of advanced sensor technology and on expediting the process of getting them patentable and/or commercially feasible. The Centre seeks to develop state-of-the-art interdisciplinary and market-oriented research facilities. With this infrastructural capacity, it aims to assist and provide facilities for researchers and faculty members with innovative ideas in the field of sensors design and technology who lack adequate facilities to carry out their research. The idea is to encourage researchers across the state of Maharashtra in particular and the entire country in general, to take up frontier research work without the uncertainties regarding funds for costly equipment and infrastructure. Researchers are encouraged to submit their proposals electronically and the approval process is fast. Further, the Centre allows young researchers/students to undergo training on sensor science and to get introduced to sophisticated equipment and instrumentation. Finally, the Center enables one time characterization and/or fabrication against prescribed charges.

Research is carried out on various themes:

- Materials for sensor and other Application
- Sensors for analytes in Gaseous phase
- Sensors for analytes in Liquid phase
- Sensors for Biological Analytes
- Equipment for Sensor Interface

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- Remote Sensing Analysis of Surface Materials and Vegetation

FUTURE RESEARCH AND EDUCATION PRIORITIES TARGETED AT THE ECONOMY

Main current and future research priorities

The research priorities at BAMU are specific for the various faculties and departments. They are presented below.

In the field of Computer Science & Information Technology:

- Speech Processing
- Pattern Recognition
- Artificial Intelligence
- Human Computer Interfacing
- Biometrics and Security
- Knowledge Engineering
- Software Engineering and Testing
- Computational Psycho-Linguistic
- Brian Computer Interfacing
- Image Processing & Analysis
- Computer Networking
- Data Mining and Data Warehousing
- Remote Sensing, GIS
- Natural Language Processing

In the field of Physics:

- Thin Film and Nanotechnology
- Magnetic Materials
- Dielectric Research
- Intelligent Materials
- Advanced Materials
- Microwaves and Soil Physics
- Spectroscopy and Fractals Research
- Nuclear Physics
- Molecular Interaction

In the field of Chemistry:

- Synthesis of biodynamic / therapeutic organics.
- Convenient, benign and cost effective synthetic protocols for value added materials.

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- Homogeneous, heterogeneous catalysis including bio and biomimetic catalysts.
- Kinetics and mechanism of reactions.
- Synthesis, characterization and applications of transition metal complexes and nanocomposite materials.
- Thermodynamics of solid – liquid and liquid – liquid mixtures
- Nanotechnology
- Coordination Chemistry
- Heterogeneous catalysis, Natural and synthetic zeolites, Mixed metal oxides, Theoretical studies of chemical molecules using DFT method.
- Chemical Kinetics, Macrocyclic Ligand Coordination Chemistry.

In the field of nanotechnology:

- Thin Films for various technological applications
  - Sensors (gas and biosensors)
  - Solar cells (Solid state, DSSC, Organic and hybrid solar cells
  - Protective barriers
  - Transistors etc.
- Green Nanotechnology
- Bio nanotechnology
- Nanotechnology in Defence applications
- Nan composites and their technological applications
- Nanotechnology for Analytical Chemistry
- Environmental applications of nanotechnology
- Nanotechnology in Biomaterials and Biomedical applications
- Carbon nanotubes and their technological applications

In the field of statistics:

- Operations Research
- Design and Analysis of Experiments
- Actuarial Statistics

In the field of electronics:

- Sensors (Gas phase, liquid phase, bio elements)
- Solid State Devices (Silicon alternatives, heterostructures,

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organic Electronics, flexible electronics)

- Instrumentation (Bottom Up integration)
- Industry solutions

In the area of environmental science:

- Water pollution
- Waste water treatment
- Solid Waste Management
- Underground water quality
- Toxicology
- Hazardous Waste management
- Environmental Impact Assessment
- Wild life
- Biodiversity and eco-sustainability studies
- Hydrobiology and Limnology
- Aerobiology
- RS, GIS and its application in Environmental Science
- Energy Studies
- Environmental Biotechnology, etc.

In the field of Biochemistry:

- Plant Pest Interaction
  - Identification of Plant defence proteins
  - Identification of evasive mechanisms in Insect Pest
- Therapeutic Use of Protease Inhibitors
  - Renin-Angiotensin System Inhibitors
  - Blood Clotting Cascade
- Virus discovery, persistence, MDR
  - Proteomics, bioinformatics

In the field of Chemical Technology:

- Natural Product Chemistry
- Pharmaceutical Analysis
- Biopharmaceutics & Pharmacokinetics
- Medicinal Chemistry
- Synthetic chemistry
- Drug Design

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- Food Processing & Preservation
- Food Biotechnology

In the area of tourism:

- Ambedkar Tourism
- Buddhist Tourism
- Marketing
- Corporate Social Responsibility
- Socio-Economic Impacts
- Heritage Tourism Management
- Tourist Police

In the area of commerce:

- General Commerce,
- Management,
- International business and Entrepreneurship development.

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University priorities for research and innovation targeted at inclusive economic growth

DEPARTMENTAL PRIORTIES

BAMU is in general strongly committed to providing quality education for rural youth. We see this as our most basic contribution to inclusive economic growth.

Yet, there are some priorities for research and education that are specifically targeted at inclusive economic growth. They are dependent on the focus of the different departments at the School of Social Sciences.

The Department of Economics is one of the two oldest departments at the University. While it focuses on the advanced study of Economics, teaching and research at the Department include the following current and future priorities that are directly related to inclusive economic growth:

- Indebtedness, agrarian distress, social inclusiveness, social security, food security financial positions of Panchayat Raj institutions
- Unorganised Labour
- Water conservation in dry areas of Marathwada
- Women and work
- Socio-Economic conditions of deprived sections of society

These priorities specifically reflect the pressing social challenges in the state of Marathwada– a region comprising some of most backward districts in the country. The Department has been awarded the status of Centre with Potential for Excellence in Particular Area (CPEPA): "Rural Development in Backward Districts of Marathwada".

The Department of Political Science was established in 1960. The Department of Political Science aims at inculcating the values of higher learning and research among the disadvantaged students of Marathwada. It has always boasted researchers that are socially committed. Teaching and research at the Department focus on two main priorities that are directly related to inclusive economic growth:

- Gender Studies
- Studies of Backward Regions

The Department of Education was established in 2006 in order to address the need for training qualified teachers in the region. It offers M.Ed., B.Ed.-M.Ed., M. Phil. and Ph.D. degrees. This area of education will continue to be a priority for the region due to the lack of sufficient number of teachers at different levels of education.

The Department of Psychology was established in 1972. It contributes to addressing regional problems and issues of the mentally retarded children and is working in close association with Children's Institute and Nursing Homes and Hospitals for the Mentally Retarded. This will continue to be a priority contributing to sustainable development in the region.

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The Department of Life Long Learning and Extension aims at the eradication of illiteracy. It is a crucial element of BAMU's contribution to sustainable development in the region. Its work covers large areas of backward region of Marathwada and includes Jan Shikshan Nilayam Continuing Education, Population Education, Planning forum and total Literacy campaigns. The department conducts several training camps, workshops, campaigns, seminars for Aids Awareness, Programmes for prisoners, empowerment of Women, Rural cleaning campaigns, personality development for youth, eradication of superstition, etc. The Department runs various community-based program:

- Village adoption program
- Extension center program at sixty college
- Student counselling, carrier guidance program at sixty Colleges
- Extension training program

Among the current priorities for research are:

- Lifelong Learning & Extension
- Non-formal Education
- Interdisciplinary
- Marathi Language and Literature
- Education
- Linkage between education and rural livelihood.

The Department of Social Work Education focuses specifically on issues of inclusiveness and social challenges. Students are placed in social work institutions to learn and practice social work intervention skills and techniques. Among the agencies that are available for field work are schools of mentally ill children, observation homes, training centres for the blind, juvenile homes, homes for aged persons, homes for children with HIV/AIDS, training centres for people with disabilities, government state homes for women, urban livelihood missions, Arambh Society for Autism and Slow Learners Children, etc.

Among the priorities for education are:

- Provision of social services for various groups of disadvantaged persons, including children
- Parents' training program for sensitization and developing intervention skills for rehabilitation of children with autism
- Adolescent education programs
- Health awareness programs
- Stress management programs
- Mental Health Awareness Programs

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- Conducting counselling sessions for sexually abused girls
- Counselling for adoptive parents.

RELEVANT RESEARCH AND EDUCATION CENTERS

Gopinathrao Munde National Institute of Rural Development & Research

This Center offers education in the area of rural studies. The curricula for the different two-year Masters' degrees focuses on Cultural & political Aspects, Rural Economics, Banking & Industry, Biodiversity and Rural Technology. The educational offer of this institute is directly informed by the challenges faced by the region.

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

DEPARTMETNAL PRIORITIES

BAMU's contribution to research and innovation targeted at pressing challenges facing societies in Southern and Southeast Asia are concentrated in the School of Life Sciences, and specifically in the Department of Botany and the Department of Zoology.

- **School of Life Sciences**

The Department of Botany at the School of Life Sciences was established in 1962. It is a pioneer in leaf protean and Aerobiology research in India. It has one of the largest University Herbariums in the country and one of the largest University Botanical gardens. It also runs its own journal- *Indian Botanical Reporter*. The department has a number of current research projects on Plant Biodiversity, Plant Physiology and Plant Pathology.

The following are the current research areas:

- Plant Physiology: concerns nitrogen metabolism and organic productivity. The various aspects into which research in the latter field has branched off were agronomy, intercropping, etc., and a dietary supplement in humans. These efforts were acclaimed and the Films Division, Govt. of India, produced a 16-minute documentary on this research. The other areas around it are silage, DPJ utilization, green manures and compost. It has directed its attention to biotechnological aspects like enzyme immobilization and tissue culture studies.
- Plant Pathology: Research was initiated on Mycology and fungal enzymology, subsequently, research in soil microbiology, pesticide resistance, seed technology and pathology, aflatoxin, bacteriology microbial ecology and aerobiology are undertaken.
- Cytogenetics: This section is engaged in the fundamental cytological aspects of some angiosperm taxa. The Department has developed strains of legumes which may find their way in the market as a savoury vegetable and in tackling the problem of protein malnutrition existing in tribal groups.
- Angiosperm Taxonomy: This section covers the discipline of floristics, biosystematics, cytotaxonomy; vegetative, floral and developmental anatomy, evolutionary floral morphology and biology Pharmacognosy, Phytochemistry. Chemotaxonomy, Bioprospecting and Molecular taxonomy have been undertaken recently.

The Department of Zoology, School of Life Sciences, was established in 1959. The Department has a DNA Bar coding facility in its Paul Herbert Center with state of art facilities. This is one of the departments with highest number of Research projects. It has signed

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MoU with institutions of higher learning in countries like Israel, Poland, New Zealand, East Africa and Slovakia.

The Department has established a Marine Research Laboratory at Bhatye, Ratnagiri – the Centre for Coastal and Marine Bio-diversity. The Laboratory has made significant contribution to research on prawns, crabs, oysters, mussels, and clams, and this contribution is widely recognized in India and abroad. The research contribution in marine living invertebrates made by this department is far greater than other University department located on the west Coast of Maharashtra State.

Another major achievement of the Department is the initiative to assist farmers to increase their farm yield with the Lab of Bee Keeping Department of Zoology Professor Waykar.

The following current and future research priorities in the field of Zoology stand out:

- The Fishery Science
- Animal Physiology
- Molecular Biology
- Applied Parasitology
- Invertebrate Zoology
- Helminthology
- Protozoology
- Entomology
- Applied Zoology

Other major research topics that require interdisciplinary collaboration are:

- Green Technology for energy harvesting
- Plant Molecular Biology
- Water Conservation

RELEVANT RESEARCH AND EDUCATION CENTERS

Paul Herbert Centre for DNA Barcoding & Biodiversity studies

This Center is a nodal centre of DNA barcoding and is dedicated to the study of biodiversity at the species level. It is also in charge of interdisciplinary biodiversity initiatives that bring together the BAMU biodiversity-related research community. As a part of a global initiative, during the past years, the Centre played an important role in biodiversity mapping using universal DNA Barcoding technology. Research focuses on all aspects of biodiversity - from soil microbiome and human gut microbiome to the social, ethical and legal issues associated with emerging science. This research seeks to design solutions to major challenges of industry and society, including breeding better plants, improving and protecting animal and human health, stepping-up

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conservation and environmental assessments, detecting marketplace fraud, and enabling more effective control of invasive pest species and disease vectors. This Center has a good scope for potential expansion.

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

Under its Corporate Social Responsibility plan, the Bajaj Group of Industries has financed the University with Rs. 1.5 Crores to setup the Bajaj Incubation Centre. The Centre is already functional and is located on the University Campus. The University has appointed a fulltime Director and several supportive staff to run this Incubator. In addition, the State Government and the Central Government have sanctioned Rs. 5 Crores and 10 Crores respectively for setting up the Maharashtra State Incubation Centre and the Atal Incubation Centre on the University Campus. BAMU has initiated the process for setting up these Incubators. These steps are taken to enhance the entrepreneurial skills of the University's graduates and to help them become gob generators rather than job seekers.

The following are some of the key areas identified by BAMU for involving students in Innovation and Research activities:

- Food & Farma
- Bio-Chemistry
- Apiculture
- Physics-Electronics
- Silk and Handcrafts
- Botany- Plant Biology, Winery, Medicinal Plants/Drugs.
- Aurvada- Indian Traditional Medication Science.
- Geo Spatial Technology focussed on assisting farmers
- Eco-needs- Alternate Energy- Green initiatives
- Hotel Management- Home Science
- Yogashastra
- Archaeology
- Tourism
- Human Recourse Management and Leadership Building
- Water Management - rain water harvesting, recharging water, water recycling, purification and conservation
- Increasing the green belt through researching and adopting "Dense Forest" technology in collaboration with Japanese expertise.
- Languages and Soft Skills, aimed at increasing workforce quality in line with the demands of focal industries like for e.g., Tourism, Hotel Management.
- Disaster Management.

Students are already involved in Innovation and Research activities at Dr. Babasaheb Ambdkar Marathwada University in the following ways:

- As per University Grants Commission (UGC) requirements, the University has modified all the course contents in each Faculty and has introduced several research components which are taught starting from the second semester. At the beginning, in the second semester, students learn basic principles of research along with the art of mastering tools and techniques of research. This is strictly followed in Professional Courses, Science/Technology subjects, a few subjects in Humanities and Inter-

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disciplinary Studies. After they get the theoretical knowledge needed for conducting research, students in those Departments receive a Mini Research Project that needs to be carried out by adopting both Doctrinal and Non-Doctrinal research methods. In the fourth semester students are obligated to take up exclusively project writing assignments based on the research problem selected and worked upon. In this context, as per the requirement of the research problem selected by the individual student, s/he will be directed to go to the Laboratory, Field, Society, Research Institutes etc., for continuing work and finalization of the Project Report.

- Following the evaluation of the quality of research conducted by students, students may be prompted to publish their work and to get in touch with the University's Incubation Center to incubate their research outcomes.
- At the Bajaj Incubation Centre, 14 young scientists both from University Departments and Affiliated Institutions have already registered and are placed in a Pre-Incubatee stage after evaluation of their proposals by the In-house Expert Committee. They are from Information Technology, Engineering, Chemical Technology, Material Science, Electronics, Music, etc. Further, a group of students along with Experts are yet to be involved in market research to find out the required consumer market for the products proposed by these Pre-Incubatees. This will be followed by inviting a detailed business plan from each Incubatee which will be placed before the Board of Directors and a day will be fixed for the presentation before the said Board. Presently, the University is in the process of getting information and support from financial agencies (Government or Private Sector) who may come forward to finance these scientists to convert their ideas into products and launch them in the market. Once the product reaches the market and the business turnover exceeds Rs. 1 Crore, the Incubatee will be detached from the Incubation Center. The above proposed plan is in the pipeline for implementation.

Limitations to the involvement of students in research

Fighting against all odds, BAMU is striving to create the right opportunities for students to develop their talent and skills - by developing state-of-the-art infrastructure, unique academic ambience and competent academic community comprising both traditional teaching staff and industrial experts. Despite these efforts, there are many limitations and setbacks that need immediate attention:

- Poorly developed language skills and lack of soft skills amongst students
- Widespread social and economic backwardness in the region
- Students' irregular attendance due to economic constraints in the families to fund students' education expenses, which forces students to work in order to earn their living.
- Inadequate number of experts invited to train the students
- Lack of modern techno savvy students' community
- Less opportunities to undertake internship assignments, as in the majority of disciplines internship is not a compulsory part of the courses
- An alarmingly high students-teacher ratio as a result of the Government's ban on recruitment of teachers in Maharashtra (in force since 2014)

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- Acute need for redesigning the contents of the majority of courses, especially in the Faculties of Humanities, Interdisciplinary Studies and basic Sciences, notably by incorporating components intended to increase the employability of graduates
- Inactive Placement Cell
- Understaffed Departments
- Need for a more effective system for monitoring the career paths of former students
- Need for more initiatives promoting use of green energy
- Accommodation for students on demand in hostels is yet to be achieved.

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