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IQAC
UNIVERSITY OF KERALA

RESEARCH HANDBOOK

(FOR MPHIL & RESEARCH SCHOLARS)

Handbook for Research Scholars
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Disclaimer

This is a helpful documentation of information and motivational reading that may be use to research scholars of the University of Kerala. While effort has been taken to provide accurate and authentic information, it may be noted that this is not a document which should be relied on as legally undertaken by the University of Kerala. Remarks made are not that of the University of Kerala. The University's stances on all matters are as duly debated and adopted by the University authorities (the Senate, the Academic Council and the Syndicate). For any final confirmation, a formal communication from the University of Kerala may only be relied on.

Handbook for Research Scholars (2017-18)

Internal Quality Assurance Cell
University of Kerala
2017-18

തിരുവാഴ്ത്ത്

(ഓ.എൻ.വി. കുറുപ്പ്, 1987)

ആരുടെ തിരുമുമ്പിൽ സ്വാതന്ത്ര്യമന്ത്രം ചൊല്ലി
പാരിനെയുണർത്തിയ കവിതൻ പ്രതിരൂപം
'മാറ്റുവിൻ ചട്ടങ്ങളെ!'യെന്ന നിർഘോഷത്തിന്റെ
മാറ്റൊലിയെന്നും മൗനഗംഭീരമുണർത്തുന്നു.
ആരുടെ മതിലകം പൂകുന്നു നാടിൻ തരു-
ണാരുണ പ്രതീക്ഷകളാത്മസാഫല്യം തേടി,
ആരുടെ നിത്യാസ്വാസ്ഥ്യം പ്രജ്ഞയെ നിജകർമ്മ
സാരഥിയാക്കി പുത്തൻ രഥ്യകളന്വേഷിപ്പൂ,
നിത്യയൗവനയാകുമാ വിശ്വകലാശാലാ-
മുത്തശ്ശിക്കൊരു തിരുവാഴ്ത്ത് പാടുക നമ്മൾ!
മലയാൺമ തൻ മാറ് ചുരന്നൊരമൃതവും,
മധുരാക്ഷരമോലുമന്യമാം മൊഴികളും,
മൺതരിയിലെ മഹാകാശവും താരാപഥം
തന്നിലെ സ്പന്ദങ്ങളും തിരയും ശാസ്ത്രങ്ങളും,
ചിന്തകളുരസി നൽക്കനലായ് പാറും തീയും
അന്തരംഗത്തിൽ പേറും അമ്മയ്ക്കീ തിരുവാഴ്ത്ത്!

<u>സർവ്വകലാശാല ഗാനം*</u>

(വി. മധുസൂദനൻ നായർ, 1997)

വന്നു തൊഴും മനസുകളിൽ നിന്നെരിയും പൊൻ തിരിയായ്
കർമ്മമെഴും പ്രജ്ഞകളിൽ നിർമ്മലമാം താമരയായ്
തലമുറയായ് ഒഴുകിവരും മലയാള തെളിനദിയായ്
വജ്ര മണി കതിരണിയും വിജ്ഞാന ശ്രീപദമേ
വാഴുക നീ വാഴുക നീ വിശ്വകലാ നിലയനമേ
വളരുക നീ വളരുക നീ വിശ്വ മഹാദീപകമേ

**സർവകലാശാല സംഗീത വിഭാഗം 'സരസ്വതി രാഗത്തിൽ ചിട്ടപ്പെടുത്തിയത്.*

Vice - Chancellor's Message

The University of Kerala, mother University of the state, has crossed a land mark, it has turned 80 years old this year, on 1 Nov, 2017. Founded as University of Travancore in 1937, our University has been at the forefront of the renaissance of the Kerala society during the 20th century. The portals of the University as well as colleges affiliated to it have resounded with debates and creative expressions, which synchronised with the social transformation of Kerala to a more equal society. Led by very eminent scholars, administrators and scientists such as Sir C. P. Ramaswamy Iyer, Sir Harod Papworth and Prof. R. S. Krishnan, the saga of its research had profound impact on economic development of the state, starting with path breaking research in aquatic biology, production of new fuel to run the State Transport corporation during the second world war, to invention of coloring dyes from natural sources in the recent times. Its store house of traditional wisdom archived in the Oriental Manuscripts library is a pride of the nation, from where lost works of Bhasha were discovered. Our University has not been found wanting in balancing its academics with addressing aspirations of the students, for which it exists. Our University is proud of its empowered students who have been integrated into all the decision making bodies of the University including the syndicate, since 1977.

Lot of changes have happened in the regulations and rules of Ph.D and M.Phil programmes, consequent with the UGC's interventions, in recent times. While some of these changes have brought in difficulties, it should not be forgotten that there are many aspects of these changes that will enhance quality of research. We live in a time where research and innovation have become increasingly important in academic arena. This compilation, documenting key information about the University system and learning infrastructure, along with a collection of scholarly articles on research process from various experts, is a step towards improving quality of research. It is hoped that this handbook will go a long way in improving quality of research.

01.01.2018 ***Prof. P. K. Radhakrishnan***

Note from the Editor

In the present days, quality of research is serious topic of discussion in public domain, in addition to research institutions. Several research studies are undertaken in every year in Universities and research institutions. But in most cases not enough attention is given to the research methodology. One can also observe the ignorance of the research scholars on research facilities available to them, research rules and regulations etc. Very recently the UGC has come out with some measures on the research degrees. Everybody agrees that significance of research lies in its quality and not in quantity. In our University also many debates are going on regarding research and its quality improvements. Keeping all this in view, the present book has been compiled and published, providing first-hand information of use to research students.

The book consists of 7 Parts. It is primarily intended to serve as handbook for MPhil and PhD scholars on various aspects of research in the University of Kerala. We shall feel greatly rewarded if the handbook proves helpful in the development of genuine research in the University of Kerala and the research students are hassle free in many aspects of rules and regulations on research. We look forward to suggestions from all the experienced researchers and supervising teachers for further improving this handbook in the years to come.

We thank all contributors to articles. General parts of the book overlaps with the PG Handbook and is intentionally so. I thank Prof. Achuthsankar S. Nair for his active involvement and support in the compilation of this handbook.

Dr. G. Prasad
Associate Professor, Dept. of Zoology
University of Kerala

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A1. Coat of Arms

The conch shell was the national emblem of erstwhile state of Travancore. The traditional book stand with palm leaf manuscript on it, symbolizes scholarship. Both are portrayed inside a lotus. The motto drawn from Panchathanthra (a Buddhist work) reads "Karmani Vyajyathe Prajna" which roughly translates to "Wisdom manifests in action".

The stanza is

"Manthrinaam Bhinna Sandhaane,
Bhishajaam Saannipaathike,
Karmani Vyajyathe Prajna,
Swasthe Ko Va Na Panditha"

A2. Vision & Mission of University of Kerala

The University of Kerala aims at fostering scholarship which is independent, critical, innovative, inclusive and emancipatory in a manner that it contributes to the intellectual, cultural, social and economic development of the individual and the society.

Mission

Towards achieving the vision, the University shall continuously:

- *Design, implement, and review and revise schemes for promoting innovation*
- *Strengthen its policies for ensuring inclusiveness to ensure equity and access to education for all*
- *Focus teaching and research in inter-disciplinary and multi-disciplinary areas with a view to promote economic vitality, environmental sustainability, and quality of life in Kerala and beyond*
- *Adopt, promote and disseminate eco-friendly practices*
- *Ensure world class infrastructure, equipped with latest technologies*
- *Promote transparency, social accountability and democratic practices in its functioning*
- *Bestow its attention on cutting edge sciences, technologies and humanities*
- *Strengthen its social relevance by tuning teaching and research to suit local and global social needs*
- *Initiate pedagogic reforms in tune with technology and times*
- *Develop human potential to its extreme extent for the creation of intellectually talented and imaginatively gifted leaders, who are locally oriented and globally competent*
- *Promote reciprocal linkages with local and global industries and also with the rest of the world*
- *Facilitate transformation of the University as a favourite destination for niche areas of its focus*
- *Facilitate, promote and disseminate critical reason in all disciplines for the rationalization and emancipation of humanity*
- *Define and refine working definitions of quality, excellence and access based on universal principles*
- *Re-engineer its administrative system and practice to suit the vision*
- *Encourage all stakeholders of the University to constantly evolve a code of conduct to achieve the vision*
- *Facilitate measures to ensure that knowledge leads to practice, thus realizing the motto of the University, 'Karmani Vyajyate Prajna'(Wisdom emerges through action)*

A3. Accreditation and Ranking

The University of Kerala
presently exists under
The Kerala University Act
(Act 17 of 1974).

♦

The University of Kerala is
recognised by **U.G.C**. under
Sections 2(f) and 12(b).

♦

The University of Kerala is
Re-accredited by NAAC in 2015
with **'A'** Grade (highest grade)
with G.P.A of 3.03, up to 1.3.2020.

♦

The University of Kerala
is ranked **29th** among Indian Universities by the
National Institutional Ranking Framework
(NIRF) of MHRD, Govt. of India, 2017
(Highest rank by any University in Kerala).

♦

The University of Kerala
was ranked first (in 2015)
in the **Chancellor's Award for best University**
in the State of Kerala.

♦

The University of Kerala
was ranked in the band **800-1000** in
The World University Ranking by THES (in 2017)

A4. A Profile of the University

Founders of the University of Kerala (in 1937)

1. Genesis

One of the first 16 Universities in India, the University of Kerala was founded as the University of Travancore in the erstwhile princely state of Travancore (now southern part of Kerala) in 1937. Dr. C. P Ramaswamy Iyer was the founder Vice-chancellor. Since then, the University of Kerala has transformed itself in many ways. The earliest origins of the University may be traced back to two institutions of modern learning in Kerala, the University College Thiruvananthapuram and the Trivandrum Observatory. The University was modelled after the best Universities of the United Kingdom, and even today retains some of these features. The affiliating system of the University, however, evolved to be different from the college system in British Universities. The objective of the University was to effect re-organization of the system of education in the state so as to develop technical,

technological education and research in applied science, in addition to promoting Kerala Art and Culture. The Logo of the University depicts a lotus with a conch shell (a symbol of erstwhile state of Travancore) and a traditional book stand with palm leaf manuscript on it, symbolizing scholarship. The motto of the University was drawn from Panchathanthra (a Buddhist work) and reads "Karmani Vyajyathe Prajna" which roughly translates to "Wisdom manifests in action".

In 1956, the unified state of Kerala came into being. The Kerala University Act was brought into force in 1957 and the University of Travancore was renamed University of Kerala (a name which was considered even in 1937) with jurisdiction all over the state of Kerala. The 1957 Act conferred a large measure of autonomy to the University and made its administrative bodies more broad-based. In 1974, the University Act was modified again and presently the University exists under this act.

University of Kerala is today known as the "Mother University" of the state, as almost all the other Universities in the state were created by either bifurcating it or re-affiliating its affiliated colleges. These developments have shrunk the jurisdiction of the University of Kerala to Thiruvananthapuram, Kollam, Alappuzha districts and some parts of Pathanamthitta district.

Administration

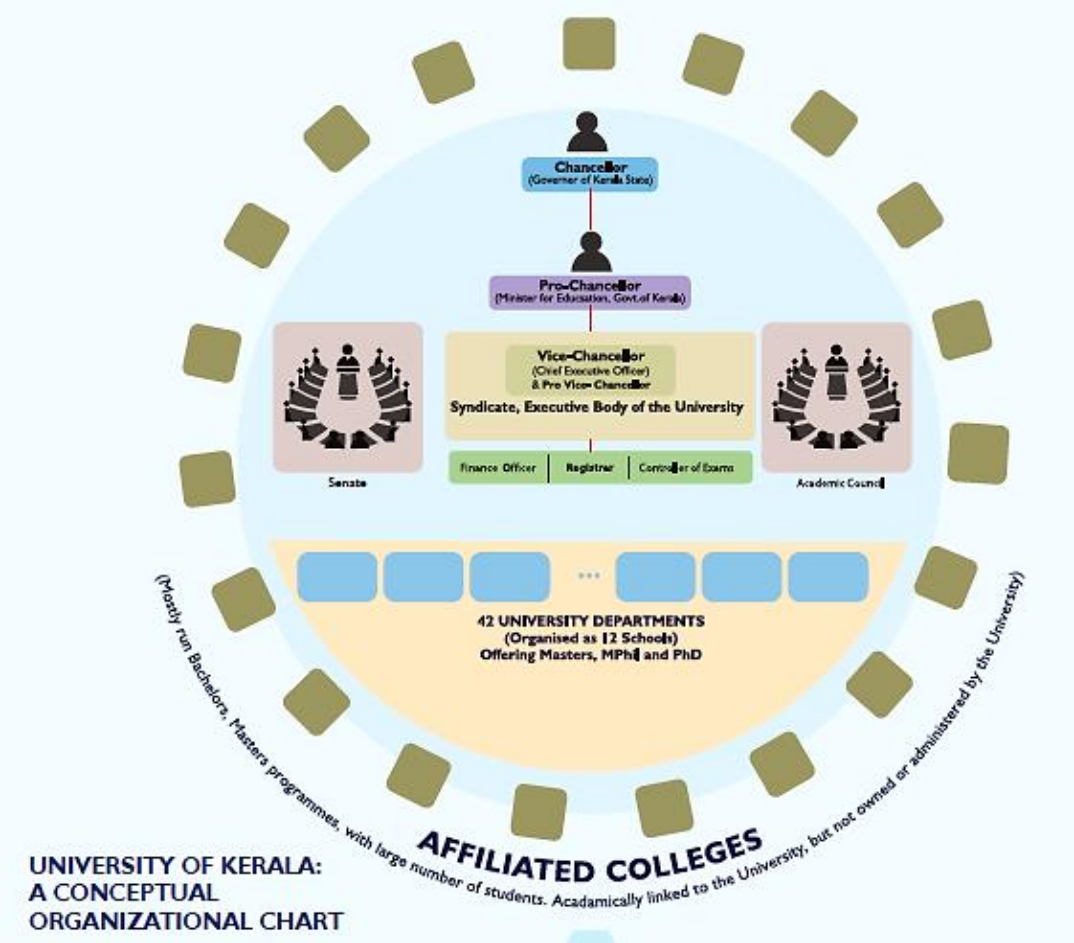
The Vice-Chancellor, appointed by the Governor of Kerala, is the Chief Executive Officer of the University. The Pro-Vice-Chancellor assists the Vice-Chancellor. The Registrar is the administrative head of the University. The University has three important representative bodies. The Senate and the Academic Council, two large bodies with wide–based representation, are the supreme bodies on general policy matters and academic matters respectively. The **Senate,** "the Supreme Authority of the University", which is reconstituted every four years, has 117 members (24 ex-officio, 78 elected and 15 nominated). It represents a cross section of the society, with its members drawn from different walks of social life. The **Academic Council** is the supreme academic body of the University. It is also a large body like the Senate, with its members drawn from different spheres of academic spectrum. The Academic Council has the power to make regulations and to advise the Senate and the Syndicate on all academic matters, to prescribe programmes of studies in the University, to prescribe the qualifications of teachers, to make provision for the admission of students to the various programmes etc. The **Syndicate,** the chief executive body of the University, has a strength of 25 (*including the Vice-Chancellor, the Pro-Vice-Chancellor, the Secretary to Govt. (Higher Education), the Secretary to Govt. (IT Dept.), the Director of Public Instruction, the Director of Collegiate Education, twelve elected members, one elected student member, six nominated members, including one nominated by KSHEC*). The Syndicate, which meets ordinarily once in a month, has executive powers including the general superintendence and control over the institutions of the University. See ***Appendix*** for a maximum detailed description of the Legal Framework of the University.

Teaching and Research

The University of Kerala has its own departments of teaching and research (housed in University campuses) and also affiliates a number of colleges, spread over four southern districts of the state. The forty two departments of teaching and research are organized as nine schools, and most of them are housed in the Karyavattom campus. Teaching, research and knowledge extension are the mandates of the departments. They primarily focus on post-graduate (masters) programmes, MPhil programmes (1-year research degree started in 1973) and doctoral (PhD) programmes and post-doctoral programmes. Affiliated colleges run large number of bachelor's programmes and lesser number of masters and doctoral programmes. University's research activities are also going on in select affiliated colleges and other recognized research centres. The total number of full-time students in the University departments is about 2500, including research students.

The University has also established 10 University Colleges of Teacher Education (KUCTE) and 17 University Institute of Technology (UIT), both of which offer under-graduate programmes (B.Ed. in UTECs and BSc (Computer Science/IT/Electronics) and BBA in UITs), although masters programmes are available in select UITs. The University College of Engineering at Karyavattom offers Engineering education at Undergraduate level. These institutions together have student strength of more than 6000. The Institute of Distance Education has student strength of approximately 30,000, which is spread across the country.

The University has over 150 affiliated colleges with an enrolment of over 1,30,000. Thirty two colleges offer Post Graduate teaching programmes. **Only one** of the affiliated colleges offer M.Phil programmes and some have been recognized as research centres.



In addition to the departments of teaching, the University also has several centres for studies and research in specialized areas. Some of these centres have taught programmes (Certificate/Diploma/Masters/MPhil). The University has also instituted three chairs: Dr. B. R. Ambedkar Chair, Mahathma Ayyankali Chair and V. K. Sukumaran Nair Chair.

2. Campuses

The University of Kerala has two major campuses, the largest being the Kariavattom Campus, 12km from the city Centre. The Palayam/Senate Hall Campus is right in the middle of the city. Depts. of Music and Education, the University Stadium, the Student Centre, International Youth hostel, the Centre for Continuing Education, and Aakkulam campus are in separate locations in the city, all quite close to the Palayam Campus. The Palayam Campus (housing the heritage building of the Travancore University) has mainly the administrative office of the University, including the Vice-Chancellor's, Pro-Vice-Chancellor's and Registrar's office. The majestic Senate Hall with a seating capacity of 1352 seats in ground floor and 300 seats in balcony is housed in the middle of the campus. In addition to the office of the Controller of Examinations and Computer Centre, the Palayam Campus also houses the departments of English, German & Russian, and the School of Distance Education and Student Amenities Centre.

Thirty six departments are situated in the Karyavattom Campus. This sprawling green campus (359 acres) is close to Kazhakuttom, on the National Highway 47, towards north. The famous Trivandrum Technopark is adjacent to the University Campus.

3. Student Empowerment

The University of Kerala is well known for empowering its students. The University Union is an active presence in the University life since 1939. The University Union, Department's Union, Researcher's Union are all forums that are established through democratic process and positions in these forums are fiercely competed for. Elected student representatives have membership in supreme bodies of the University such as Senate, Academic Council and also Syndicate, the executive committee of the University (Student representation in Syndicate was given for the first time in India, by University of Kerala, in 1977). The Co-ordinator of the National Service Scheme (NSS) Programme and the Director of the Student Services organize youth welfare activities with the active co-operation of the Unions. The graduate attributes envisaged by University of Kerala is articulated visually through a creative video.

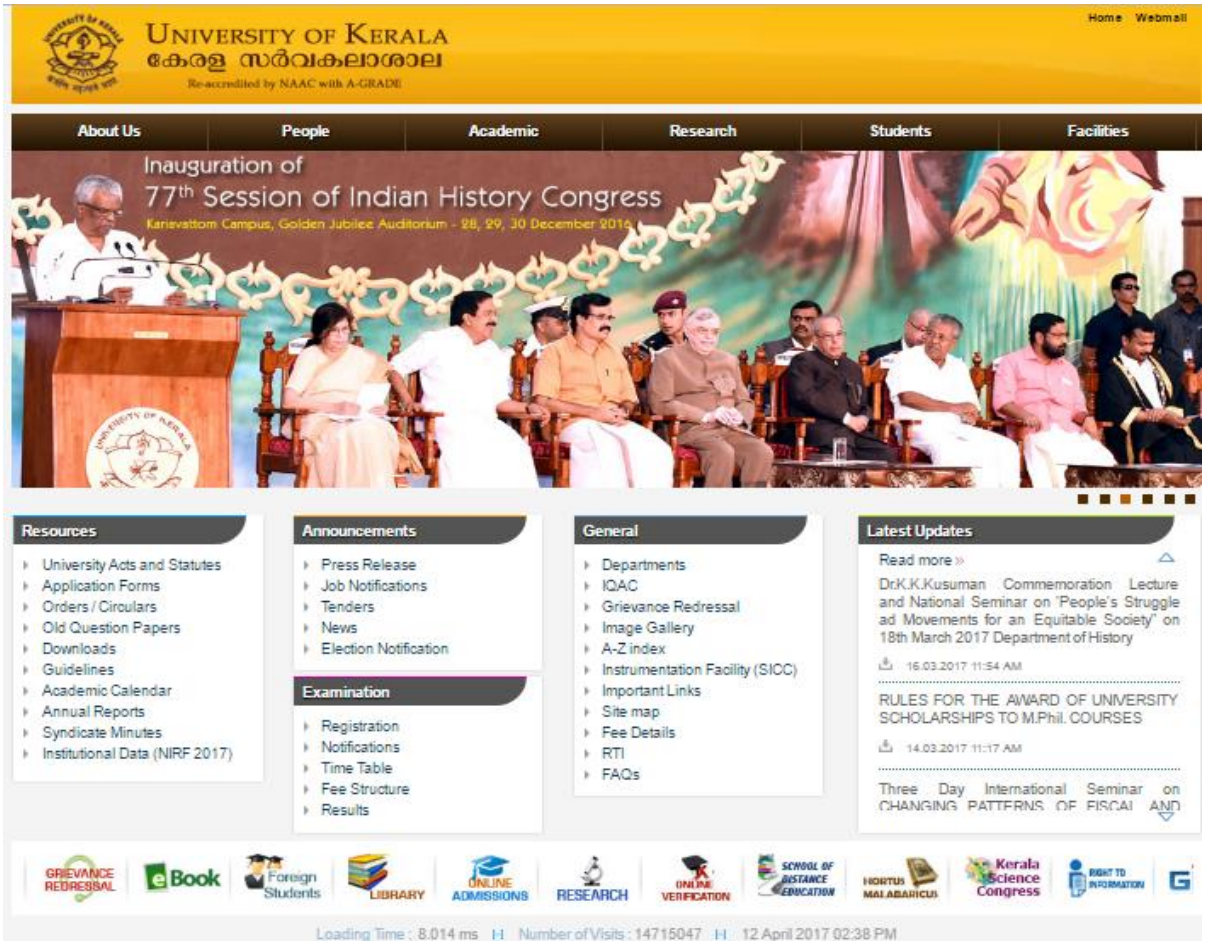
The gender profile of the students in the University reveals a unique picture: 76% of post graduate and 75% of MPhil students in University departments are women. 67% of research scholars are women. UG students in affiliated colleges also have 56% of women. Out of 343 PhDs awarded in 2015, 67% were awarded to women.

4. Institutions

(i) Oriental Research Institute and Manuscript Library, Karyavattom, established in 1904, is a treasure trove of Indian culture. The library has over 65,000 works in 30,000 copies mainly of palm leaf manuscripts, in addition to paper manuscripts, copper plates, birch bark and textiles. The manuscript collection also includes those belonging to Burma, Malaysia, Indonesia, Nepal etc. This can be rated as one of the "must see" libraries of the world.

(ii) Kerala University Library System: The University library system has over 8 lakhs books. The University has a Central Library (Kerala University Library-KUL) near its city campus and caters to the knowledge quest of all students, staff and public. In addition to KUL (3,30,000 books) Karyavattom campus has a Campus Library. Department libraries (above 5,00,000 books) and College libraries (each with 20,000 – 1,00,000 books) provide information service to students. It has rare books and bibliographies in its collection.

(iii) The University Computer Centre has a history of over half a century (dating back to the use of a Czech made electro-mechanical computer "Arithma" in 1950s and Core-Memory based IBM-1620 computer and Indian made TDC 316 in 1970s) and, today spearheads the University's e-Governance initiatives. Computing support for research is no longer centralized, thanks to the advent of affordable desk-top computing power. The University's Academic campus in Karyavattom is firmly connected to the cyber highway with broad-band connection flowing into over 2000 computers. The entire campus network is being upgraded to 10 GBPS optical fibre connection. State of the art digital studio is coming up in the campus for recording/developing video lectures, with sound proof lecture hall, video editing, speech to text conversion etc.



The University web site has also evolved since 2000 to become an indispensable cyber forum that connects the university community and serves information to all stake holders. The web site offers on-line admission portal and PhD portal and is one of the most visited sites of the state, in public domain. University also has an official email system.

The University also judiciously uses technology in many ways to serve academics & governance including systems such as 24 hour digital camera surveillance, over 100 digital security features in Hologram affixed degree certificates, digitization of archival records, online admission for both University teaching Departments and affiliated colleges, online grievance redressal system etc.

(iv)The Department of Publications, one of the oldest departments of the University, has brought out several noteworthy publications including Saraswathi Kantabharanam, a treatise on Sanskrit Grammar, the five volumes of Kerala Sahitya Charithram by Mahakavi Ulloor S. Parameswara Ayyar and Sahithya Nayakanmar (Men of Letters) Series, Chitra Ramayana, based on palm-leaf manuscripts. The University has also published the first ever complete English and Malayalam translation of Hortus Malabaricus, the classical

treatise on the plant wealth of Kerala (which have been inspiration to world renowned Botanist Carl Linnaes). The first e-Book, Swathi Thirunal's 'Bhakthi Manajari' was published in 2013. The department publishes around 20 books per year.

(v)The UGC-Human Resource Development Centre, University of Kerala (formerly ***Academic Staff College***) set up with the aid of UGC in 1987, offers specially designed in-service courses like Orientation Programmes, Refresher Courses and Short-Term Courses for teachers of universities and colleges across the country for capacity enhancement and knowledge upgradation. So far 660 courses have been conducted and 23,767 teachers have been trained through these programmes. This HRDC is adjudged as the top ranking institution in the country for the last ten years in the matter of largest number of courses conducted and high number of candidates participated.

(vi)The Centre for Adult & Continuing Education (CACEE) aims at "further education" of the educated' for which it received UNESCO – NLM Award. The centre offers a wide variety of courses in collaboration with other agencies to further continuing education.

(vii) Malayalam Lexicon is one of the largest and greatest dictionaries in modern Indian languages. The Lexicon department of the University has published nine volumes of the Lexicon by 2015, running to nearby 9000 pages, in an effort spanning half a century.

(viii) Sophisticated Instrumentation and Computation Centre (SICC) is a state of the art scientific instrumentation centre and computation facility which has been set up in the Karyavattom campus in 2015-2016.

(ix) Kerala University Teaching and Business Start-Up Centre (KU-TBSC): It promotes students startups in campus. Started in 2006 as Industry Incubation Centre, one company was started in the same year in the campus. Presently, many start-ups have been sanctioned.

5. Academic System

The University has a 3-tier academic system. Each subject of study has a Board of Studies to design syllabus and propose action on all academic matters. Group of related subjects are grouped together and defined as a faculty. The University has 16 faculties. Finally Academic Council is the supreme academic body. The University follows the Choice based credit and semester system for all post-graduate (masters) programmes and under-graduate (bachelors) level. Semesters typically fall during the months of August-January and February-July. Masters programmes are typically of two year duration and have four semesters with 5 to 6 courses offered each semester. The final semester has a project and

thesis requirement. MPhil programmes are post-masters research degree, offered under credit and semester system since 2016.

6. Programmes Offered

Post-Graduate Degree Programmes

M.A. : Arabic, Archeology, Economics, English, German, Hindi, History, Islamic Studies, Linguistics, Malayalam, Music, ORI & Manuscript Library, Philosophy, Political Science, Psychology, Russian, Sanskrit, Sociology, Tamil

M.Sc.: Acturial Science, Aquatic Biology and Fisheries, Biochemistry, Biotechnology, Botany, Chemistry, Computational Biology, Computer Science, Demography, Environmental Sciences, Evolutionary and Integrative Biology, Geology, Mathematics, Physics, Statistics, Zoology

M.Tech.: Computer Science, Future Studies, Opto-Electronics

MBA: Management

M.Ed.: Education

MSW: Sociology

LLM: Law

M.Com: Commerce

M.LI.Sc.: Library and Information Science

M.Phil & PhD: All Departments (M.Phil: except Opto-Electronics)

Certificate & Diploma Programmes

Dept. of Law: Certificate Course in Human Rights and Duty Education, P.G. Diploma in Human Rights, P.G. Diploma in medical law ethics and Human Rights **Dept. of German:** Certificate Course in German, Diploma in German **Dept. of Russian:** Certificate Course in Russian, Diploma in Russian, Integrated Diploma in Russian, Advanced Diploma in Russian Translation **Dept. of Biotechnology**: P.G. Diploma in Molecular Diagnostics **Dept. of Future Studies:** P.G. Diploma in Knowledge Management **IU- CGIST**: P.G. Diploma in Geo- Information Science & Technology **CACEE:** Certificate Course in Library and Information Science, Diploma in Computer Application, Certificate Course in Computerized Accounting, Certificate Course in Yoga and Meditation, P.G. Certificate in Counselling, P.G. Diploma in Yoga Therapy, Certificate Course in Health and Sanitation, Certificate Course in T.V. News Reading and Compering, P.G. Diploma in Counselling

Psychology, Certificate Course in Comm. English & Public Speaking **Centre for Vedanta studies:** Certificate Course in Yoga

Distance Education Programmes

Science, Humanities and Commerce Programmes: MA: Economics, History, Political Science, Public Administration, Sociology; **M.Com:** Commerce; **M. Sc:** Mathematics; **Language and Literature Programmes: MA:** English, Hindi, Malayalam; **Library Science Programmes:** Master of Library and Information Sciene (MLISc) **IT Programmes: M.Sc.:** Computer Science

Science, Humanities and Commerce Programmes: BA: Economics, History, Political Science, Sociology **BBA:** Bachelor of Business Administration **B.Com:** Commerce, **B. Sc.:** Mathematics **Language and Literature Programmes:** Malayalam, English, Hindi **IT Programmes:** Computer Science, Computer Applications (BCA) **Library Science:** Library and Information Science (B. LI. SC.)

7. Miscellaneous

University has had among its faculty's eminent scholars who were trained under legendary figures: Sir C. V. Raman's student in Department of Physics, Hans J. Eysenk's (German Psychologist) student in Psychology, Prof. S. R. Ranganathan's student in Library Science, Pearson's student in Statistics and Prof Benjamin Bloom's student in Education. Some of the faculty members themselves were legends, such as famous poet K. Ayyappa Panicker, Oriental scholar T. Ganapathi Sasthri and Padmasree N. Balakrishnan Nair, among others. Many eminent scholars led this University as Vice-Chancellors: Sir. C. P. Ramaswamy Iyer, Sir Harold Papworth, Prof. A. Aiyyappan, Prof. R. S. Krishnan, Prof. J. V. Vilanilam, Dr. B. Ekbal and Prof. A. Jayakrishnan, among others.

The University of Kerala celebrated its silver jubilee in 1962, golden jubilee in 1987, diamond jubilee in 1997, and Platinum Jubilee, in 2012.

The University has an active Internal Quality Assurance Cell (IQAC) that continuously monitors and analyses quality aspects and designs microscopic initiatives to enhance quality. The University has Start-up scheme since 2006 and presently the "Kerala University Technology and Business Start-up Centre" nurtures student Startups. The University Consultancy Cell coordinates the consultancy services offered by various University Departments. Services include routine ones such as water quality testing, Arabic Translation etc to testing using sophisticated instruments and development of software.

University has an Innovation Council to promote innovation and it conducts activities such as 'innovation contests, ideathons, grand challenges etc.

University has a Research Council and a Director of Research. University's research output in 2015 resulted in 343 PhDs, 2 patents filed, hundred publications with total impact points of 200 (average impact factor of 2). Recent innovative research from University departments include safe and natural food colourant, improved dye-sensitised solar cells, correlation of low cholesterol to hair loss, sensor to detect pesticide presence, ceria incorporated composite Hot Dip Galvanic Zinc coating, anti-cancer molecule form curcumin, new scientific performance measure 'M"-score, enhanced production of solasodine, method for retrieval of separate endodontic files from human root canals, a new species of mushroom (*O.nidiformis*), improved gene finding and sub-cellular localization algorithms, novel high-k dielectrics, development of substrates for surface enhanced Raman spectrology, isolation of new lead molecules from marine organisms, use of DNA barcoding technology for documenting threatened marine mammals, models on tectono-thermal evolution of shear zones in south India and a strain of bacteria that can completely degrade the pesticide chlorpyrifos.

The University regularly honours scholars and eminent personalities by conferring honorary degrees. In the past it had conferred honorary degrees on Thakazhi Sivasankara Pillai, Chemmangudi Sreenivasa Iyer, Prof. Ilya Progogine, Sri. M.P. Appan, Sri. Suranad Kunjan Pillai etc. Recent awardees include Nobel laureate Prof. Amartya Sen (2000), Sri. K. J. Yesudas (2003), Mr. Laurie Baker (2003), Sri. O.N.V Kurup (2007), Sri. G. Madhavan Nair (2007), Justice K.G. Balakrishnan (2008), Sri. Adoor Gopalakrishnan (2010), Sri. Mammootty (2010) and Sri. Umayalpuram K. Sivaraman (2010).

The University bagged the Indira Gandhi National Award for the best NSS activities in 2005, and the UNESCO-NLM award for literacy in 2005, State Govt's award for e-Governance in 2010 and the first Chancellor's Award for the best University in the State of Kerala, in 2015. It is re-accredited with **'A'** grade by NAAC in 2015 and ranked the **29th** Best University in India by National Institutional Ranking Framework (NIRF) 2016, MHRD of Govt. of India. It has been ranked in 800-1000 band among World Universities by Times Higher Education Supplement (THES) World Ranking of Universities.

The University had the privilege of hosting Indian Science Congress during 2010 and the Indian History Congress in 2016. The University also regularly invites eminent scholars to the campus including Nobel Laureates. Prof. Dr. Johann Deisenhofer (Nobel Prize in

Chemistry, 1988), Prof. Martin Chalfie (Nobel Prize in Chemistry, 2008), Dr. Anders Liljas (Nobel Prize Committee Member), Prof. Ada E. Yonath (Noble Prize in Chemistry, 2009), Professor Michael Levitt (Noble Prize in Chemistry 2013) and eminent Professors such as Dr. Robin Jeffry.

8.1. Unique Kerala specific factor of the University

Even when most of State Universities bear name of a region in Kerala, University of Kerala has the pride of bearing the name of the state itself, even after its jurisdiction has been limited to southern part of the state. Almost all Universities in the state are born out of University of Kerala. The University continues in its pan-Kerala outlook. Here are a few evidences:

- University's Act mandates it with pan-Kerala outlook.
- Kerala is known for Women Empowerment. University of Kerala has a gender record in this aspect. According to the Times Higher Education World University Survey, University of Kerala is the second largest University in the world in terms of percentage of women among students.
- The Oriental Manuscripts Library of the University is a treasure house of traditional knowledge of Kerala and is also a national pride.
- The University's most prominent publication to date – the 10 volume *Hortus Malabaricus*, delivered to the country the English translation of the Dutch work that documents the plant biodiversity of Kerala.
- The Malayalam Lexicon undertaken by the University since 1960s, is one of the largest and greatest dictionaries in modern Indian languages.
- The International Center for Kerala Studies in Kariyavattom and the Kerala Studies section in University Library are both unavoidable reference centers for scholars of Kerala Studies.
- The University maintains one of the oldest Astronomical Observatories of the country (Est.: 1838) and the oldest surviving observatory in the state. It is also the first institution of modern science in the state. The observatory provides astronomical computations for preparation of Government Calender, a practice since 19th century.
- The University Library systems with over eight lakhs books are easily the largest in the state. It has produced indices specific to Kerala authors.

- Since 1972, The University's Centre for Computing Cost of cultivation (attached to Dept of Economics) has been collecting data to enable determination of minimum support prize for coconut and paddy from the state, for Ministry of Agriculture, Govt of India.
- In terms of honoring cultural leaders and scholars, the University has a pan-Kerala history – Chemmangudi Sreenivasa Iyer, Thakazhi Sivasankara Pillai, M.P. Appan, K.J. Yesudas, Laurie Baker, O.N.V. Kurup, G. Madhavan Nair, Justice K.G. Balakrishnan, Adoor Gopalskrishnan, Mammotty …the list of its honarary confermet is self-evident.'

A5. Legal Framework of University Administration[1]

The Kerala University is established as a body corporate by the Kerala University Act, 1974. The basic legal framework of University Administration is provided by this Act. The Kerala University Act contains provisions on the powers and functions of various officers and authorities of the University, composition of University bodies, Finance, Affiliation of Colleges etc. On all these matters, only the most essential provisions are included in the Act and supplementary matters are left to subordinate legislation to be made by the Senate, Syndicate and the Academic Council.

Statutes

The Senate has the power to make Statutes on the following matters:

(a) The powers and duties of the officers of the University, not specifically provided for in the Act;

(b) The constitution, powers and duties of the authorities of the University, not specifically provided for in the Act;

(c) The procedure for election of members of the Senate, the Syndicate, the Academic Council and other authorities of the University and all such other matters relating to these bodies, as may be necessary or desirable to provide;

(d) Award of degrees, diplomas, titles, certificates and other academic distinction by the University;

(e) The withdrawal or cancellation of degrees, diplomas, titles, certificates and other academic distinctions;

(f) The maintenance of a register of registered graduates

(g) The holding of convocations to confer degrees;

(h) The conditions and procedure for affiliation of colleges;

(i) Conferment of honorary degrees;

(j) The maintenance of the accounts and the preparation and passing of the annual budget of the University:

Ordinances

The Syndicate is given the power to make Ordinances providing for:

(a) the levy of fees in colleges and other institute the University;

(b) the residence and-discipline of students;

(c) the work load and pattern of teaching staff in colleges

[1] Contributed by Prof N K Jayakumar, former HOD of Dept of Law

(d) the fixation of the scales of pay of various posts in the University and the terms and conditions of service of officers of the University.

Regulations

The power to make Regulations providing for the following matters is vested in the Academic Council.

(a) the courses of studies and the conduct of examinations;
(b) the admission of students to the various courses of study and to the examinations;
(c) the qualifications of teachers
(d) the appointment and prescription of duties of the Boards of Studies and examiners
(e) recognition of examinations, degrees and diplomas of other Universities as equivalent to the examinations, degrees and diplomas of the University; and
(f) all other matters which, under the provisions of the Act, the Statuettes and the Ordinances, are to be, or may be, prescribed by Regulations.

Rules, Bye- Laws & Orders

In addition to the lawmaking powers, the Syndicate shall have power to make Rules, Bye-laws and Orders not inconsistent with the provisions of the Act, the Statutes, the Ordinances, and the Regulations, for the guidance and the working of the Boards and Committees and other bodies, and for regulating the procedure and conduct of business at meeting of any authority of the University other than the Senate.

The Act, The Statutes, Ordinances, Regulations, Rules, Bye-laws and Orders may be collectively called the laws of the University. Every action of the Officers and authorities of the University must be in compliance with the laws of the University.

Officers and Authorities of the University

The powers of the University are enumerated in Section 5 of the Act. The powers are exercised through Officers and authorities of the University.

The Chancellor is the head of the University. The Governor of Kerala shall, by virtue of his office, be the Chancellor of the University. The Chancellor has the power to annul any proceeding of any of the authorities of the University which is not in conformity with the Act, the Statutes, the Ordinances, the Regulations, the Rules or the Eye-laws. The Chancellor can suspend or dismiss any of the authorities of the University and to take measures for the interim administration of the University, when an emergency arises. An appeal shall lie to the Chancellor against any order against any person in the service of the University. The Chancellor is also given the power to remove the Vice-Chancellor or the Pro-Vice-

Chancellor from office on charges of misappropriation or mismanagement of funds or misbehaviour. But this power cannot be exercised unless the charges are proved by an enquiry conducted by a person who is or has been a judge of the High Court or the Supreme Court appointed by the Chancellor for the purpose.

The Pro-Chancellor: The Minister of Education of the State shall be the Pro-Chancellor of the University. In the absence of the Chancellor or during his inability to act, the Pro-Chancellor shall exercise all the powers and perform all the functions of the Chancellor.

The Vice-Chancellor is the Principal academic and executive officer of the University. It is his duty to ensure that the University laws are faithfully observed and carried out. When the Syndicate or the Academic Council is not in session, the Vice-Chancellor may take any action involving the exercise of powers by the Syndicate or Academic Council, if he is satisfied that an emergency has arisen requiring him to take immediate action. .

The powers and functions of the Pro-Vice-Chancellor, Registrar, Controller of Examinations and Finance Officer are prescribed by the Statutes.

Authorities of the University: The authorities of the University are the Senate, Academic council, Faculties Boards of Studies, Students Council and the Finance committee.

The Senate is the Supreme Authority of the University. It has the power to review the actions of the Syndicate and the Academic Council, save when the Syndicate or Academic Council has acted in accordance with the powers conferred by the University laws. The Senate is also entrusted with residuar power, ie, powers not otherwise provided for by the Act or Statutes.

The Senate shall have the following powers:

(a) to determine what degrees, diplomas and other academic distinctions shall be granted by the University;

(b) to make, amend or repeal Statutes either, of its own motion or on the motion of the Syndicate;

(c) to cancel or amend b a majority of the total membership of the Senate and by a majority of not less than two-thirds of the members present and voting, any ordinance passed by the Syndicate or any Regulation passed by the Academic.

Council

Provided that no Regulation shall be cancelled or tended by the Senate without giving the Academic Council an opportunity to state its opinion on the proposed cancellation or amendment; of dismissal passed by the Syndicate or the Vice-Chancellor

(d) to institute fellowships, scholarships, studentships, bursaries, medals and prizes and organise exhibitions in accordance with the provisions of the Act and the Statutes. Ordinances and Regulations:

(e) to institute professorships, readerships, lecturerships and such other teaching or research posts as it may deem necessary

(f) to establish and maintain such institutions as it may from time to time deem necessary

(g) to prescribe with the previous concurrence of the Government the terms and conditions of service of the employees of the University;

(h) with the previous concurrence of the Government, to regulate the emoluments and prescribe the duties and conditions of service of teachers' and non-teaching staff in private colleges;

(i) to review and take such action as it may deem fit on the annual report and the annual accounts of the University which shall be placed before it by the Syndicate and to consider and pass the budget according to the provisions of the Statutes;

(j) to cancel any degree, diploma, title- or any other distinction granted to any-person .in accordance with the provisions of the Statutes;

(k) to appoint committees and to delegate to them such functions of the Senate as it may deem fit

(1) to make Statutes regulating the method of election to the authorities of the University, the procedure at the meetings of the Senate, the Syndicate and other authorities of the University and the quorum of members required for the transaction of business by the authorities of the University other than the Senate;

(m) to recommend to the Government the recognition of any local area within the University area as a University Centre;

(n) to co-operate with other Universities and other authorities in such manner and for such purposes as it may determine;

(o) to exercise such other powers and perform such other functions as may be assigned to it by the Act and the Statutes.

The Syndicate: is the Chief Executive body of the University, Executive powers of the University including the general superintendence and control over institutions of the University shall be vested in the Syndicate. The Syndicate has the following powers;

(i) to affiliate institutions in accordance with the terms and conditions of such affiliation prescribed in this Act and the Statutes;

(ii) to make ordinance and to amend or repeal the same;

(iii) to propose Statutes for the consideration of the Senate.

(iv) to hold, control and administer the properties and funds of the University:

(v) to direct the form, custody and use of the common seal of the University:

(vi) to arrange for and direct the inspection of colleges, hostels and other institutions and to constitute a Board of Inspection for that purpose;

(vii) to establish, maintain and manage colleges and institutes of research and other institutions of higher learning as it may from time to time deem necessary;

(viii) to appoint teachers and other employees of the University and prescribe their duties;

(ix), to create administrative, ministerial and other necessary posts;

(x) to suspend, discharge, dismiss or otherwise take any disciplinary action against teachers and other employees of the University after Giving them reasonable opportunity to defend their position:

(xi) with the previous sanction of the Government to fix and regulate the fee payable by students in colleges affiliated to the University,

(xii) to award fellowships, scholarships, studentships, bursaries, medals and prizes;

(xiii) to exercise supervision and control over the residence and discipline of students;

(xiv) to consider the financial estimates of the University and submit them to the Senate in accordance with the provisions of the Statutes made in this behalf.

The Academic Councils is the academic body of the University. It shall have general regulation and the responsible for the maintenance of standards of instruction, education and examination within the University. The following powers, duties and functions 'are-assigned to the Academic Council.

(i) to advise the Senate and the, Syndicate on all academic matters;

(ii) to make Regulations and to amend or repeal the same

(iii) to prescribe the courses of studies in the institutions maintained by or, affiliated to, the University;

(iv) to prescribe the qualifications of teachers -

(a) in colleges, and

(b) in the institutions maintained by the University;

(v) to prescribe the qualifications for admission of students to the various courses of studies and to the examinations and the conditions under which exemptions may be granted,

(vi) to make provision for the admission of students to the various courses of studies on the basis of merit, in order to maintain standards of education;

(vii) to make proposals for the instruction and training in such branches of learning as it may think fit;

(viii) to make proposals for research and advancement and dissemination of knowledge;

(ix) to make proposals for the institution of professorships, readerships, lectureship and other teaching and research posts required by, the University;

(x) to make proposals for the institution of fellowships, traveling fellowships, scholarships, studentships, medals and prizes;

(xi) to make proposals for determining what degrees, diplomas and other academic distinctions shall be granted by the University;

(xii) to decide what examinations of other Universities may be accepted as equivalent to those of the University and to negotiate with other Universities for the recognition of the examinations of the University.

(xiii) to arrange for the co-ordination of studies and ' teaching in affiliated colleges and recognize destitutions and

(xiv) to exercise such other powers and perform such other duties as may be conferred or imposed on it by, this Act or the Statutes, Ordinances, Regulations, rules or bye-laws.

Faculties: A Faculty shall have power

1) to consider and report on any matter referred to it by the Senate, the Syndicate, the Academic Council, the Students' Council or the Vice-Chancellor;

(2) to make recommendations to the Academic Council in all matters relating to the organisation of University teaching, courses of study, examination and research in the subjects of study comprised in the Faculty and to propose additions or amendments to the Ordinances or Regulations as the case may be, relating to these matters for the consideration of the Syndicate or the Academic Council as the case may be;

(3) to recommend to the Syndicate, the names of persons suitable for appointment as Examiners in the subjects comprised in the Faculty

(4) to call for proposals from the Boards of Studies in the subjects comprised in the Faculty regarding syllabi and text-books for the courses of study;

(5) to consider any report or recommendation of any Board `of Studies comprised in the Faculty;

(6) to remit any matter to the Boards of Studies comprised in the Faculty for consideration and report;

(7) to appoint Committees the Faculty to consider and report on matters referred to them;

(8) to recommend to the Vice-Chancellor the holding of joint meetings of two or more. Faculties to consider any matter of common interest to them; and

(9) to recommend the syllabi and text-books, in consultation with the Boards of Studies, for the courses of study in the subjects comprised in the Faculty. There are …. 16 faculties

(Arts, Social Science, Commerce, Education, Engineering & Teaching, Law, Management Studies, Oriental Studies, Physical Education, Since, Fine Arts, Ayurveda, Medicine, Homeopathy Applied Science, Dentistry.

Boards of Studies: Powers of the Boards of Studies are:

(1) to recommend for the guidance of teachers and students; books in which the prescribed subjects are suitably treated, and, to recommend text-books, when such are required.

(2) to recommend persons suitable for appointment as Question Paper Setters, Examiners in the subjects with which it deals;

(3) to make recommendations in regard to courses of study and examinations in the subjects with which it deals;

(4) to address the Faculty or Faculties concerned regarding improvements in the, courses of study.

(5) to consult, specialists who axe not members of the Board;

(6) to recommend to the Academic Council for being forwarded to the Syndicate for its approval, the preparation and publication of selections or anthologies of the writing or works of authors and other masters in any subject or group of subjects; together with a synopsis of the selections or anthologies, and the names of the authors and masters and of the persons who may in its opinion be appointed to make the selections; and

(7) to bring to the notice of the Academic Council or the Syndicate, as the case may be, matters of importance relating to the examinations. in each subject or group of subjects.

Finance Committee: Annual accounts and Financial Estimates of the University shall be laid before the Finance Committee for consideration and comments. The Kerala University First Statutes, 1977 also provide that no expenditure other than that provided for in the budget shall be incurred by the University without consulting the Finance Committee,

The following proposals shall be implemented only in consultation with the Finance Committee.

(a) Grant of additional monetary benefit not provided for in the service rules, to an employee;

(b) Proposals for making or amending financial and accounting Rules;

(c) Proposals for the creation or abolition of any post, the maximum pay of which is Rs. 700 and above per mensem.

(d) Any other item having financial implication which the Vice-Chancellor may refer it for advice;

The powers and functions of the Finance Committee, as laid down by the Statutes, are:

(a) examine the draft annual estimates of income and expenditure and annual accounts of the University;

(b) scrutinize every item of new expenditure not provided in the Budget Estimates of the University,

(c) advise the Syndicate in regard to the strict observance of the Statutes relating to the maintenance of accounts of income and expenditure of the University;

(d) examine- and report on the accounts of the Endowments and Trust Funds;

(e) Consider ways and means and financial effect of every new measure in contemplation involving fresh financial commitment on the part of the university;

(f) Make recommendations, whenever it deems necessary to the Syndicate on all matters relating to the finance of the University;

(g) Scrutinize and report on the utilization of the grants and loans given by the University through the University to affiliated colleges or recognized institutions;

(h) advise on any financial matter that may appropriately be referred to it for opinion by any authority or body of the University; and

(i) have the right to call for any paper bearing on any financial proposal or any item of accounts matter for its consideration or in making its recommendations on the annual accounts or the financial estimates.

A6. Departments & Schools

DEPARTMENTS-ALPHABETICAL LISTING

1.	Aquatic Biology& Fisheries
2.	Arabic
3.	Archaeology
4.	Biochemistry
5.	Biotechnology
6.	Botany
7.	Chemistry
8.	Commerce
9.	Comm. & Journalism
10.	Comp. Biology & Bioinformatics
11.	Computer Science
12.	Demography
13.	Economics
14.	Education
15.	Institute of English
16.	Environmental Science
17.	Futures Studies
18.	Geology
19.	German
20.	Hindi
21.	History
22.	Islamic Studies
23.	Law
24.	Library & Info. Science
25.	Linguistics
26.	Malayalam
27.	Management (IMK)
28.	Mathematics
29.	Music
30.	Nano science &Technologies
31.	Optoelectronics
32.	Oriental Research Institute
33.	Philosophy
34.	Physics
35.	Political Science
36.	Psychology
37.	Russian
38.	Sanskrit
39.	Sociology
40.	Statistics
41.	Tamil
42.	Zoology

DEPARTMENTS-STREAM WISE

SCIENCE AND TECHNOLOGY	
1.	Aquatic Biology& Fisheries
2.	Biochemistry
3.	Biotechnology
4.	Botany
5.	Chemistry
6.	Comp Biology & Bioinformatics
7.	Computer Science
8.	Demography
9.	Environmental Science
10.	Future Studies
11.	Geology
12.	Maths
13.	Nano Science & Technology
14.	Optoelectronics
15.	Physics
16.	Psychology
17.	Statistics
18.	Zoology
SOCIAL SCIENCES	
19.	Archaeology
20.	Commerce
21.	Communication & Journalism
22.	Economics
23.	Education
24.	History
25.	Islamic History
26.	Library and Information Science
27.	Law
28.	Management (IMK)
29.	Philosophy
30.	Political Science
31.	Sociology
ARTS AND HUMANITIES	
32.	Arabic
33.	Institute of English
34.	German
35.	Hindi
36.	Linguistics
37.	Malayalam
38.	Music
39.	Oriental Research Institute
40.	Russian
41.	Sanskrit
42.	Tamil

SCHOOLS: BUSINESS MANAGEMENT AND LEGAL STUDIES: Commerce, Law, Management; **COMMUNICATION AND LIBRARY SCIENCE:** Communication & Journalism; Library & Information Science; **EARTH SYSTEM AND SCIENCE:** Geology, Environmental Science; **ENGLISH& FOREIGN LANGUAGES:** Arabic, Institute of English, German, Russian**; FINE ARTS:** Music; **INDIAN LANGUAGES:** Linguistics, Hindi, Malayalam, Sanskrit, Tamil, Oriental Research and Manuscripts Library; **LIFE SCIENCES:** Aquatic Biology& Fisheries, Biochemistry, Biotechnology, Botany, Zoology; **PHYSICAL AND MATHEMATICAL SCIENCE:** Chemistry, Demography, Mathematics, Physics, Statistics; **SOCIAL SCIENCES:** Archaeology, Economics, Education, History, Islamic Studies, Philosophy, Political Science, Psychology, Sociology; **TECHNOLOGY:** Computer Science, Futures Studies, Optoelectronics, Computational Biology & Bioinformatics, Nano Science& Technologies;

A7.University Fact Sheet (2016-17)

1	**Name of University**	University of Kerala
2	**Year of Establishment**	01-11-1937 (16th University in India)
3	**Chancellor**	Governor of Kerala
4	**Pro-Chancellor**	Minister for Education, Govt. of Kerala
5	**Vice-Chancellor**	Prof. P.K. Radhakrishnan
6	**Statutory Bodies**	Syndicate (26 members), Senate (103), Academic Council (119)
7	**Charter**	Kerala University Act of 1974 (Act 17 of 1974). Earlier governed by Travancore University Act of 1937 and Kerala University Act of 1957.
8	**UGC Recognition**	Recognized under section 2(f) and 12 (b)
9	**Type**	Multi-disciplinary University
10	**Source of funding**	Govt. of Kerala Grants, UGC Grants, Internal Revenue
11	**Motto**	*Karmani Vyajyate Prajna* (Wisdom manifests in action)
12	**Website**	www.keralauniversity.ac.in
13	**e-mail**	registrar@keralauniversity.ac.in
14	**Telephone**	0091-471–2305631(Registrar)
15	**NIRF Ranking (2016)**	29th among Universities, 47th in overall category
16	**World Rankings (THES)**	Ranked in the band 800-1000
17	**NAAC Accreditation**	Re-accredited with 'A' Grade with GPA of 3.03, up to 1.3.20
18	**Address**	The Registrar, University of Kerala Palayam, Thiruvananthapuram - 695 034, Kerala, India
19	**No. of Schools**	9
20	**No. of Departments**	42 (Science and Technology: 16; Social Sciences: 14; Arts and Humanities: 11) + School of Distance Education.
21	**No. of Faculties** *(Subject Groups)*	16 **Arts, Commerce, Education, Fine Arts, Law, Management, Oriental Studies, Science, Applied Sciences & Technology, Social Sciences**, Engineering & Technology, Physical Education, Ayurveda & Siddha, Homeopathy,

		Medicine, Dentistry *(University has Departments in 10 of these only, shown in bold).*
22	**Administrative Branches**	General Administration, Examination, Finance, Planning & Development, College Development Council, Engineering, Public Relations
23	**Administrative Staff**	Registrar (1), Controller (1), Finance Officer(1), Other Officers (10), Joint Registrar (7), Deputy Registrar (20), Asst. Registrar (54), Section Officer (271), Asst. cadre (740), Office Superintend (57), Others (Technical, Security etc) = 290, Contract (251), Non-Teaching Contract employees in UIT,UIM etc. (96)
24	**e-Governance**	e-tendering, e-Certificate verification, Online Admission, Digital signature, Office Automation, Bio-metric attendance system, Campus wide CCTV surveillance, Paperless examination process, Separate online portals.
25	**Water usage**	The University has constructed 3 mega wells as a part of rain water harvesting, by which the usage of water from Kerala Water Authority has considerably reduced.
26	**Average Electricity usage**	Normal Usage : 9000 units/month Peak Usage : 25000 units/month Off-peak Usage : 45000 units/month Charges : Rs.11 lakhs/month
27	**Power Station (Karyavattom)**	Two 11KV/415V OLTC Transformer(KEL) each 315 KVA; One 500 KVA dry type (Uni Power). Total 1130 KVA.
28	**Non-Conventional Energy use**	100KW solar energy plant at Karyavattom Savings (of around Rs. 1 lakhs per month)
29	**Budget for 2015-16**	378.79 Crores (Salary: 132 Crores, Pension: 101.49 Crores)
30	**Major Project Funding** (01.07.2016-30.06.2017)	UGC - Rs. 1.25 Crores; KSCSTE - Rs. 63.56 Lakhs; SERB - Rs. 58.76 Lakhs; ICSSR - Rs. 8 Lakhs; Govt. of Kerala – 6.17 Lakhs; NCSCM – 5.70 Lakhs; MoEF & CC- Rs. 16.50 Lakhs-; MHRD – Rs. 50,000/-; DST – Rs. 1.80 Lakhs; ICMR – Rs. 7.98 Lakhs; DAE-BRNS – Rs. 14.10 Lakhs; ISRO- Rs. 6.71 Lakhs-; DoE & CC – Rs. 1.75 Lakhs; RUSA – Rs. 12.96 Lakhs; PURSE

		Grant (DST) – Rs. 2.57 Crores. **Govt. of Kerala:** State Plan Grant – Rs. 26 Crores SIUCEB – Rs. 1 Crore, IUCEIB – Rs. 2 Crore.
31	**Campus Area in Acres**	1. Karyavattom Campus: 363.13 acres: (a) North Campus 105.29 acres (including 37 acres on lease to National Games Secretariat + 1.5 acres on lease to KHRI) (b) South Campus: 257.84 acres 2. University Office (SH) Campus: 16.69 Acres; 3. University Stadium: 7.93 Acres + Parking Area: 0.33 Acres; 4. University Student Centre: 1.62 Acres; 5. Observatory: 0.89 Acres; 6. Women's Hostel, Thycaud: 4.70 Acres; 7. University Library: 1.57 Acres; 8. Dept. of Education, Thycaud: 0.24 Acres; 9. Akkulam Marine Museum: 1.20 Acres; 10. Alappuzha Study Centre: 0.28 Acres; 11. Pandalam Study Centre: 0.30 Acres; 12. Ezhamkulam Village, Adoor: 0.50 Acres; 13. Raja Ravi Varma College for Fine Arts: 0.15 Acres. Grand Total = 399.53 Acres
32	**Built up Area in square meters**	Senate House Campus, Palayam: 37505; Kariavattom Campus: 1,11,768; Thycaud Campus (Women's Hostel): 6,911; University Library Campus: 2,727; University Stadium: 10,000; Department of Education, Thycaud: 1,067; Students' Centre: 3,498; Kerala University Observatory & Planetarium: 150.
33	**Staff Quarters**	160 (A,B, C, D, E & F Types)
34	**ICT Facility**	Tier 3 Data Centre, About 2000 Computers, WiFi enabled Campus, 10 GBPS Fiber Network Connectivity, High Performance Computing Facility, 38 Smart Class rooms.
35	**Physical Education Infrastructure**	Kerala University Stadium and G.V Raja Pavilion at Palayam is the hub of all sporting activities of the University with area of around 8 acres in the heart of Trivandrum. It has international standard synthetic athletic track, football field, Basketball, Volleyball, Handball, Kho Kho / Kabaddi courts and flood lights for night time events. Other Facilities: (1) Two modern Multi Gymnasiums in the G.V Raja Pavilion. (2) The Sports Hub Complex at Kariavattom Campus adjudged the best Sporting arena in India build on

		BOT basis. (3) The campus stadium in the Kariavattom Campus. (4) New multipurpose indoor stadium for Basketball, Badminton etc. at Senate House Campus, Palayam.
36	**Scientific Instruments**	iCAP Qc Series ICP-MS with New Wave NWR 213 Laser Ablation Unit; Microwave Sample digestion Unit; Scanning Probe Microscope with Peak Force Tapping Package; Laser Scanning Spectral Confocal Microscope with Multi-Fluorescence and Live-Cell Imaging; UV-Vis. NIR Spectrophotometer; Carl Zeiss EVO 18 Secondary Electron Microscope with EDS;Thermofisher Sorvall MX50 Centrifuge; High Performance Computing facility; Brucker D8 X-ray Diffractometer; Micro Raman Spectrometer; UV Visible Spectrometer; FTIR Spectrophotometer; Spectroflurometer; Impedance Analyser; Network Analyser;F-Scan setup; Muffle furnaces;Source meter; Electrometer; BOD Incubator; HPLC; PCR; RT-PCR; Atomic Absorption Spectrometer; Electrophoresis; Bioreactor; ELISA reader; Speed Vacuum Concentrator; Drug Docking Station
37	**Libraries Stock**	Total No. of libraries: 49; Total No. of books: 8,41,255; Acquisition during 2015: 21,255 books; cost of books purchased in 2016-17: Rs. 312.53 lakhs; Annual growth rate of stock: 2.53%; Total no. of library staff (Permanent): 83; (Contract): 29; Classification: DDC in 35 Libraries, CC in 8 Libraries; LIDAS, software for accessing the KUL digital archives of rare and valuable documents.
38	**Rare books in KUL**	**1. Samkshepa Vedartam** (Compendiosa Legis Explanatio Ominibus Christian's Seitu Necessaria) by Fr. Clement Pianius (First complete book printed in Malayalam printed in Rome in 1772 and published by the sacred Congregation of the Propagation of Faith. **2. Four Gospels** (Bible New Testament), Malayalam book printed in 1811 by the Courier Press, Bombay.
39	**ICT enabled class rooms**	38
40	**Auditoriums**	1652 seater Senate hall and a dozen additional halls.

		Golden Jubilee Auditorium - 800 seats. Seminar complex under construction- 240 seats.
41	**Students (University Departments)**	Ph.D (878 – 67% female), M.Phil (334 - 75% female), PG (1284 - 76% female), Diploma/Certificate/ Others (1138)
42	**Students (UITs/UIMs etc)**	UITs: 3731; UIMs: 435; KUTECs: 394; UCK: 406
43	**Students (Affiliated Colleges)**	UG: 99398, PG: 7577, PhD : 411
44	**Foreign Students in University Departments & Centres**	42 (Iran(11), UAE (4), Malawi (1), Yemen (12), Sudan (1) Ethiopia(6), South Sudan(1), Kenya(1), Srilanka (2), Lesotho (1), Namibia (1) Nepal (1)
45	**Student start-ups**	1 (2006-2008), 2(2016), 10 (under processing in 2017)
46	**Students Union**	1. Kerala University Union Chairman: Krishnajith R.G. 2. Kerala University Union General Secretary: Adarsh M. Saji 3. Department's Union Chairperson: Ghosh K.S. 4. Researcher's Union Chairperson: Prabhaharan K
47	**Gender Profile of Students (2016)**	***Affiliated Colleges:*** UG students: 69% Female, PG students: 80% Female, Ph.D students: 75% Female. ***Uty Depts:*** PG students: 76% Female, MPhil students: 75% Female, PhD students: 67% Female,
48	**Student Hostels**	Men (2 Hostels – 75 PG students + 22 M.Phill students + 78 Researchers), Women (3 Hostels – 353 PG students 30 M.Phill + 65 Researchers), Women (Affiliated Colleges PG & UG) – 1 hostel (304 students)
49	**Distance Education**	Distance Education programmes offered through School of Distance Education to thousands since 1976. The UGC-DEB has accorded recognition for 25 Programmes (PG-12 & UG-13) for the Academic years 2017-18 & 2018-19.
50	**Centres, Other Institutions**	Centres - 32; Lexicon Department – 1; University Institutes of Technology (UITs) - 17; University Institutes of Management (UIMs) - 7; Kerala University Teacher Education Centres (KUTEC) - 10; University College of Engineering - 1; UGC Human Resource Development Centre (Academic Staff

		College); Centre for Adult Continuing and Education & Extension (CACEE)
51	**Support Service Centres & Other Departments**	Kerala University Computer Centre, Sophisticated Instrumentation and Computation Centre; Kerala University Library; University Press; University Service & Instrumentation Centre (USIC); Engineering Unit; Health Centre – 2; Dept. of Student Services; Dept. Physical Education; Dept. of Publication; Employment Information & Guidance Bureau; Placement Cell; Finishing School.
52	**Affiliated Institutions**	Arts & Science Colleges – 104; Hotel Management – 3; Special Education – 1; Physical Education – 1; Music and Fine Arts – 3; Teacher Education – 50; MCA/MBA – 24; Law – 6; Fashion Technology – 1. Total -193
53	**Research Centres** (in addition to teaching departments of the University)	82 (R&D institutions, affiliated colleges with PG programmes)
54	**Programmes offered by University Departments & Centres**	PG – 45; M.Phil – 44 (36 +Innovative M. Phil Programmes – 9); Ph.D – 42; Certificate – 18; PG Diploma – 13
55	**No. of exams conducted per year**	15,000 examinations.
56	**Faculty Positions**	Total No. of Sanctioned posts: 291 (Prof.: 34, Assoc. Prof.: 56, Asst. Prof.: 201) Filled posts: Prof.: 3, Assoc. Prof.: 19, Asst. Prof.: 155 Posts are upgraded as a part of Career Advancement and present positions are Prof.: 31, Assoc. Prof.: 40 and Asst. Prof.: 100. In addition about 60 contract Assistant Professors work in University departments.
57	**Qualification of Permanent Faculty**	Ph.D. (94%), M. Phil (6%)
58	**Teacher - Student Ratio**	1:10 (in University Depts.)
59	**Tution Fee range for Teaching Departments (Master Programme)**	Rs. 800/- per Semester for all programmes
60	**University Terms/Semesters**	Semester 1,3 (Odd): September to February (Fall) Semester 2,4 (Even): February to August (Spring)

61	**Grading system for Masters**	O (Outstanding, *grade point 10*), A+ (Excellent, *grade point 9),* A (Very Good, *grade point 8*), B+ (Good, *grade point 7*), B (Above Average, *grade point 6*), C (Average, g*rade point 5*), D (Pass *grade point 4*) F (Fail, *grade point 0*), Ab (Absent, *grade point 0*)
62	**PhDs awarded (2016)**	300 in 2016 (Total awarded till date: over 4000)
63	**Recent Honorary Doctorates**	Prof. Amartya Sen (2000), K. J. Yesudas (2003), Laurie Baker (2003), O.N.V Kurup (2007), G. Madhavan Nair (2007), Justice K.G. Balakrishnan (2008), Shri. Adoor Gopalakrishnan (2010), Mammootty (2010) and Umayalpuram K. Sivaraman (2010).
64	**Research Publications in 2016-17**	Average Impact Factor: 1.72 (115 papers published in 2016-17 with total impact factor = 198)
65	**Patents (2015-2017)**	Filed: 6; Under filing process: 4
66	**Journals Published**	20 (One of the oldest journals in the country, Journal of Indian History is published by the University of Kerala since 1946).
67	**Book Publications**	Around 20 books per year. (Premier Publications: • 10 volumes Hortus Malabaricus on plant wealth of Kerala (English and Malayalam) • 9 Volumes of Malayalam Lexicon (nearby 9000 pages), the largest dictionary in any modern Indian Language, which has taken half a century so far • Sahithya Charithram by Ulloor)
68	**Manuscript Collection**	The Kerala University Oriental Manuscripts Library has over 65,000 works in 30,000 copies mainly of palm leaf, paper, copper plates, birch bark and textiles. The collection also covers Burma, Malaysia, Indonesia and Nepal.
69	**Oldest Institutions**	1. Observatory (1838), 2. Oriental Research Institute of Manuscript Library – ORIML (1904), 3. Department of Aquatic Biology (1937)
70	**Awards**	**1.** UNESCO - NLM Award (2005) **2.** Indira Gandhi National Award for NSS (2005) **3.** Chancellors Award for Best University in Kerala (2015)

71	**GPS (respective Campus gates)**	Palayam - **8° 30' 8.27", 76° 56' 51.5"**; Karyavattom - **8° 33' 57.14", 76° 52' 37.18"**
72	**Distances**	Karyavattom to Palayam: 12Km, Karyavattom to Thampanoor Railway Station: 14Km, Palayam to Airport: 8Km, Palayam to Thampanoor Railway Station: 2Km, Karyavattom to Airport: 13Km

A8. University Authorities &Officers

MEMBERS OF THE SYNDICATE

	Phone	
	Office	Residence
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Smt. K. Sobhana	2386206		9496102237
P. A. to Controller of Examinations	2305946	276	9037588468
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P. A. to Finance Officer	2307176	237	9288140753
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Part B: Rules and Regulations

- **Ph.D Regulations(2016)**
- **M.Phil Regulations(2016)**
- **Guidelines on Ph.D/M.Phil(2016)**
- **Anti-Plagiarism Policy (2017)**
- **Green Charter**

B1. Ph.D Regulations (2016)

UNIVERSITY OF KERALA
(Abstract)

Regulations for Award of Ph.D Degrees, University of Kerala, 2016 – Approved – Orders issued.

ACADEMIC 'E.I' SECTION

No.Ac.EI/10685(1)/2016 Thiruvananthapuram, dated 12..08..2016.

Read : 1. UGC(Minimum Standards and Procedure for Awards of M.Phil/Ph.D Degree) Regulation, 2016
2. U.O. No.Ac.EI/10685/2016 dated 20th July, 2016
3. Minutes of the meeting of the Standing Committee of the Academic Council held on 06.08.2016 (Item No: 1)

ORDER

The University Grants Commission notified the Regulations UGC(Minimum Standards and Procedure for Awards of M.Phil/Ph.D Degree)Regulation, 2016 in the Gazette of India dated 05.07.2016. The University vide paper read as (2) above has adopted the above Regulation in the University with effect from 05.07.2016.

The Standing Committee of the Academic Council vide paper read as (3) above, framed the draft Regulation for Award of Ph.D Degrees, University of Kerala, 2016 in line with the UGC Regulation, 2016 and recommended to approve and implement the same.

The Vice Chancellor has, therefore, in exercise of the powers conferred under Section 10 (13) of the Kerala University Act, 1974, approved the Regulations, for award of Ph.D Degrees, University of Kerala 2016 being implemented in the University with effect from 05.07.2016 (Copy of Regulations appended)

Orders are issued accordingly.

Sd/-
DR. M. JAYAPRAKAS
Registrar

Regulations for Award of Ph.D. Degrees
University of Kerala, 2016
(U.O. No. Ac.E1/10685(1) dt. 12.08.2016)

Regulations for Award of Ph.D. Degree, University of Kerala, 2016 are framed in supersession of the UGC(Minimum Standards and Procedure for Awards of M.Phil./Ph.D. Degree)Regulation 2009 notified in The Gazette of India [No.28, Part III-Section 4] for the week July 11-July 17, 2009; and in accordance with the UGC(Minimum Standards and Procedure for Awards of M.Phil./Ph.D. Degree)Regulations 2016 notified in The Gazette of India [No. 278, Part III- Section 4] Extra Ordinary on July 5th 2016 vide No.F.1-2/2009(EC/PS)V(I) Vol.II-in exercise of the powers conferred by clauses (f) and (g) of sub-section(1) of Section 26 of the University Grants Commission Act, 1956 (3 of 1956).

1. Short title, Application and Commencement

1.1 These Regulations are titled as *The Regulations for Award of Ph.D. Degrees, University of Kerala 2016.*

1.2 These Regulations shall be made applicable to candidates seeking registration for Ph.D. Degree from 2016 July session onwards.

1.3 Award of degrees to candidates registered/waiting for orders of registration, during the period from 11th July 2009 to 4th July 2016, based on the applications submitted in response to the University Notifications of 2016 January session or earlier for Ph.D. shall be governed by the University Regulations and guidelines thereon framed in line with the provisions of the UGC (Minimum Standards and procedure for Awards of M.Phil./Ph.D. Degree) Regulation 2009.

1.4 These Regulations shall come into force with effect from 5th July 2016.

2. Eligibility criteria for admission to Ph.D. programme

2.1 Candidates for admission to the Ph.D. programme shall have a Masters degree or a professional degree recognized as equivalent to the Masters degree of the University of Kerala in grade 'B' in the UGC 7-point scale(or an equivalent grade in a point scale wherever grading system is followed) with not less than 55% marks or an equivalent degree from a foreign educational institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of

assessing, accrediting or assuring quality and standards of educational institutions.

2.2 A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, shall be granted to those belonging to SC/ST/OBC(non-creamy layer)/differently-abled and other categories of candidates as per the decisions of the University/State Government from time to time, or for those who had obtained their Masters degree prior to 19th September, 1991.

2.3 Eligibility marks of 55%(or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned in Clause 2.2 in these Regulations are permissible based only on the qualifying marks exclusive of the grace mark procedures.

2.4 Candidates who have passed the M.Phil. programme with a minimum of grade 'B' in the UGC 7-point scale(or an equivalent grade in a point scale wherever grading system is followed) with at least 55% marks in aggregate or its equivalent shall be eligible to proceed to do research work leading to the Ph.D. Degree in the same institution in an integrated programme. A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, shall be allowed for those belonging to SC/ST/OBC (non-creamy layer)/differently-abled and other categories of candidates, as decided by the State government/University from time to time.

2.5 A candidate for whom M.Phil. dissertation stands evaluated, but the viva voce remains yet to be scheduled may be admitted to the Ph.D. programme of the same institution.

2.6 Candidates possessing a degree considered equivalent to M.Phil. degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions, shall be eligible for admission to Ph.D. programme.

3. Procedure for granting Registration

3.1 Candidates for Ph.D. programme shall be granted registration through an entrance test conducted by the University. However, for those students who qualify UGC-NET/JRF, UGC-CSIR-NET/JRF, SLET, GATE and research fellowships of central

and state Government departments/agencies as approved by the University, as the case may be, shall be eligible for exemption from the entrance test. M.Phil. degree and teacher fellowship holders shall also be granted exemption from the entrance test for registration to Ph.D.

3.2 The number of Ph.D. scholars, to be admitted to each subject of study at the University Departments/Centers and duly approved research centers, shall be decided based on number of available research supervisors and other academic as well as physical facilities available, in accordance with the norms regarding the scholar-teacher ratio(as indicated in Para 5.3), laboratory, library and such other facilities.

3.3 The University shall notify twice in May and November every year in the website and through advertisement (in at least two national newspapers, of which at least one shall be in the regional language) the number of seats for admission, subject/discipline-wise distribution of available seats, criteria for admission, procedure for admission, examination centre(s) and date(s) of entrance test(s) and all other relevant information for the benefit of candidates.

3.4 Admission shall be based on the criteria notified by the University, keeping in view the guidelines/norms in this regard issued by the UGC and other statutory bodies concerned, and taking into account the reservation policy of the State Government/University, applicable to SC/ST/OBC(non-creamy layer)/differently-abled and other categories of candidates, as decided by the State Government/University from time to time.

3.5 Candidates eligible for registration to Ph.D. shall be decided by a two stage process – Entrance Test and Interview.

3.6 Entrance test shall be conducted at the Centre(s) on the dates notified in advance and changes of centers/dates, if any, shall be notified sufficiently earlier. Syllabus of the Entrance test shall consist of questions based on research methodology (50%) and the subject of study concerned (50%).

3.7 Interview shall be conducted by the Department Doctoral Committee in such a way that the candidates would be required to discuss their research interest/area through a presentation.

3.8 It shall be assessed at the interview whether:

3.8.1 The candidate possesses the competence for the proposed research;

3.8.2 The research can be suitably undertaken at the research centre; and

3.8.3 The proposed research can contribute to new/additional knowledge.

3.9 The University shall maintain the list of all Ph.D. scholars, granted registration for research on its website on annual basis with the details, such as the name of researcher, topic of research, name of supervisor/co- supervisor, and date of enrolment/registration.

4. Duration of the Programme

4.1 Ph.D. programme shall be for a minimum duration of three years, including course work and a maximum of six years.

4.2 Women candidates and candidates with disability of more than 40 per cent may be allowed a relaxation of two years for Ph.D. in the maximum duration.

4.3 Women candidates may be provided Maternity Leave/Child Care Leave once in the entire duration of Ph.D. for a period up to 240 days.

4.4 Registration for research granted shall be automatically cancelled on the date of expiry of the maximum period specified in Clauses 4.1, 4.2 and 4.3 in these Regulations.

5. Allocation of Research Supervisor

5.1 Any regular Professor of the University/approved research centre with at least five research publications in refereed journals, approved by the UGC/ University and any regular Associate/Assistant Professor of the University/approved research center with a Ph.D. degree and at least two research publications in refereed journals, approved by the UGC/ University, may be recognized as Research Supervisor. The scientists on regular employment referred to in clause 5.2 of these Regulations may also be recognized as research supervisors.

Provided that in areas/disciplines where there is no/only a limited number of refereed journals available, the University may relax the above condition for recognition of a teacher/scientist as Research Supervisor with reasons recorded in writing.

5.2 Scientists in the regular service in research laboratories of Central/State Government, located in the geographical jurisdiction of University, may also be approved as Research Supervisor/Co-supervisor and the Scientist in Grade-D, Scientist Grade-E and Scientist Grade-F&G are equated with Assistant Professor, Associate Professor and Professor respectively, exclusively for the purpose of research supervision, subject to fulfillment of other requirements stipulated in these Regulations.

5.3 A Professor as Research Supervisor/Co-supervisor, at any given point of time, shall guide not more than eight Ph.D. scholars. An Associate Professor as Research

Supervisor shall guide up to a maximum of six Ph.D. scholars and an Assistant Professor as Research Supervisor shall guide up to a maximum of four Ph.D. scholars.

5.4 The Department, in case of topics which are of inter-disciplinary nature and where the expertise in the Department has to be supplemented from outside, may nominate a Supervisor from the Department itself as the Research Supervisor, and a Co-supervisor from outside the Department/ Faculty/College/or other Institution on such terms and conditions as may be specified and agreed upon by the consenting Institutions/Colleges and duly approved by the University.

5.5 Teachers/scientists who have retired from the service of the University/ affiliated colleges/approved research institutions, adjunct faculty, visiting faculty, technical staff, library staff, administrative staff, teachers serving outside the geographical jurisdiction of the University and teachers appointed on contract basis shall not be recognized as Research Supervisors under the provisions of these regulations.

5.6 Allocation of research supervisor for a selected research scholar shall be decided by the Department Doctoral Committee concerned depending on the number of scholars per research supervisor, available specialization among the research supervisors and research interests of the scholars as indicated by them at the time of interview.

5.7 The Department Doctoral Committee concerned shall prepare a list of eligible scholars in line with clause 5.6 of these Regulations and allocate the scholars, in the list, to the research supervisors giving due consideration to research interests of the scholars as indicated by them at the time of interview and willingness of the research supervisor in a meeting specifically convened for the purpose.

5.8 The research data, in case of relocation of the woman scholar for Ph.D. due to marriage or otherwise, shall be allowed to be transferred to the University to which the scholar intends to relocate, provided all the other conditions in these regulations are followed in letter and spirit and the research work does not pertain to the project secured by the parent institution/supervisor from any funding agency. The scholar shall give due credit to the original Research Supervisor and the institution for the part of research already done.

6. Course Work

6.1 The course work for Ph.D. shall be of a minimum of 12 credits and a maximum of 16 credits.

6.2 A minimum of four credits shall be assigned to one or more courses on Research Methodology which shall cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, and field work and other areas found relevant to the discipline concerned. Other courses shall be advanced level areas in the subjects concerned for enabling the students to acquire deep knowledge in the preparation for Ph.D. degree.

6.3 All courses prescribed for Ph.D. course work shall be in conformity with the credit hour instructional requirements and shall specify content, instructional and assessment methods duly approved by Academic Committee of CSS in the University.

6.4 The Department where the scholar pursues research shall prescribe the course(s), based on the recommendations of the Department Doctoral Committee, as stipulated under sub-clause 8.1 below, of the Research Scholar.

6.5 Scholars admitted to the Ph.D. programmes shall be required to complete the course work prescribed by the Department during the initial one year from the date of registration for research, failing which the registration for research may be cancelled. The reappearance of the scholar for the courses in which required credits are not secured shall be permitted within the duration of one year specified.

6.6 Scholars already holding M.Phil. Degree and admitted to the Ph.D. programme or those who have already completed the course work in M.Phil. programme and have been permitted to proceed to the Ph.D. in integrated course, shall also have to successfully complete the Ph.D. course work, except course(s) on Research methodology, prescribed by the Department within one year, as specified in clause 6.5 above.

6.7 Grades in the course work, including research methodology courses, shall be finalized after a combined assessment by the Department Doctoral Committee and at least one external examiner, and the final grades shall be communicated to the Vice Chairman of CSS in the University.

6.8 The Ph.D. Scholar has to obtain a minimum of 'B' Grade in the UGC 7-point scale in the course work with a minimum of 55% marks in order to be eligible to continue in the programme and submit the thesis.

7. Role of Department Doctoral Committee

7.1 The Department Doctoral Committee shall be responsible to:

7.1.1 Review the research proposal and finalize the topic of research;

7.1.2 Orient the research scholar to develop the study design and methodology of research;

7.1.3 Identify the course(s) to be undertaken; and

7.1.4 Review periodically and assess the progress of the research work of the research scholar.

7.2 The Department Doctoral Committee shall, once in six months, insist the scholar to make a presentation of the progress of research work before the Committee for evaluation and further guidance.

7.3 The Department Doctoral Committee shall communicate the six-monthly progress reports to the University and serve a copy of the same to the research scholar concerned.

7.4 The Department Doctoral Committee, in case the progress of the research scholar is not satisfactory, shall:

7.4.1 Record the reasons for the same and suggest corrective measures; and

7.4.2 Recommend to the University for cancellation of registration, if the research scholar fails to implement the corrective measures suggested, citing specific lapses on the part of the scholar.

8. Evaluation of Theses

8.1 The Ph.D. Scholar shall, upon satisfactory completion of course work and obtaining the grade prescribed in sub-clause 6.8 above, be required to undertake the research work and produce a draft thesis within a reasonable time, as stipulated by the University based on these Regulations.

8.2 The scholar shall make a pre-submission presentation of the thesis in the Department, before a Board consisting of Department Doctoral Committee, an external expert and Dean of the Faculty concerned.

8.3 Pre-submission presentation shall be open to all faculty members and research scholars/students, and the feedback and comments obtained from the participants may be suitably incorporated into the draft thesis, as advised by the Board.

8.4 The Chairperson of the Doctoral Committee shall countersign the certificate attested by the supervising teacher and contained in the thesis to be submitted to

the University, that the feedback and comments obtained from the participants are suitably incorporated into the draft thesis, as advised by the Board.

8.5 Ph.D. scholars shall publish at least one research paper in refereed journal, duly approved by the UGC/University, and make two paper presentations in conferences/seminars, recognized by the Department Council concerned, before the submission of the thesis for adjudication and produce evidence for the same in the form of presentation certificates and reprints.

8.6 The thesis submitted for adjudication shall contain an undertaking from the research scholar and a certificate from the Research Supervisor attesting to the originality of the work, vouching that there is no plagiarism using the software approved by the UGC/University and that the work has not been submitted for the award of any other degree/diploma of the University or to any other Institution.

8.7 The thesis for Ph.D., submitted for adjudication, shall be evaluated by the respective Research Supervisor and two External Examiners, who are not in employment of the University, of whom one examiner may be from outside the country.

8.8 The two External Examiners for evaluation of Ph.D. thesis shall be appointed by the Vice Chancellor from among the panel of ten experts prepared and submitted by the supervising teacher and duly scrutinized by Head of the Department and countersigned by Dean of the Faculty concerned invariably with sufficient modifications, if required, giving due consideration to the specialization in the topic of study.

9. Public Viva Voce

9.1 Public viva voce, based on the observations given in the evaluation report, shall be conducted by a Board consisting of one of the External Examiners, in the duly approved panel nominated by the Vice Chancellor, as Chairperson, Dean of the Faculty concerned and the Research Supervisor as members.

9.2 Public viva voce shall be open to all faculty members of the Department, research scholars and interested experts/researchers/students.

9.3 Public viva voce of the research scholar to defend the thesis shall be conducted only if the recommendations in the evaluation report(s) of the External Examiner(s) on the thesis, submitted in the format specified by the University for the purpose, is/are satisfactory and specific recommendation for conduct of the public viva-voce is made.

9.4 The thesis shall be sent to another External Examiner, contained in the approved panel of examiners, in case the evaluation report of one of the External Examiners is unsatisfactory and does not recommend for conduct of the public viva-voce.

9.5 Public viva-voce examination, in respect of scholars referred to in Clause 9.4 of these Regulations, shall be held only if the recommendation in the report of the third External Examiner is satisfactory.

9.6 The thesis shall be rejected, in case the recommendation in the report of the third External Examiner is unsatisfactory and the research scholar concerned shall be made ineligible for the award of the degree, based on the thesis already submitted.

9.7 A scholar who fails in the public viva voce, in the first instance, conducted to ascertain the genuineness of the research shall be required to reappear once for public viva voce within six months but not before three months from the date of conduct of first public viva voce, by remitting the fee prescribed by the University. The recommendations of the Board in the second instance shall be approved by the University and no more chance for public viva voce shall be available to the scholar.

9.8 The University shall formulate appropriate methods, so as to complete the entire process of evaluation of the thesis for Ph.D. in a time bound manner.

10. Academic, administrative and infrastructure requirement for offering Ph.D. programmes

10.1 Post-graduate Departments of affiliated Colleges and Research laboratories of Central/State Government with at least two Ph.D. qualified teachers/ scientists in the Department concerned along with required infrastructure, supporting administrative and research promotion facilities as per these Regulations, stipulated under sub-clause 10.2, shall be considered eligible to offer Ph.D. programmes, provided the other conditions specified by the University are fulfilled.

10.2 Post-graduate Departments of Colleges and Research laboratories of Central/ State Government with adequate facilities for research as mentioned below alone shall be allowed to offer Ph.D. programmes:

10.2.1 In case of science and technology disciplines, exclusive research laboratories with sophisticated equipment as specified by the University with provision for adequate space per research scholar along with computer facilities and essential software, and uninterrupted power and water supply;

10.2.2 Earmarked library resources including latest books, international journals, e-journals, extended working hours for all disciplines, adequate space for research scholars in the Department/Library for reading, writing and storing study and research materials;

10.2.3 Colleges may access the required facilities of the neighbouring Institutions/Colleges, or of those Institutions/Colleges/R&D laboratories/Organizations which have the required facilities.

10.3 Research centers, granted approval prior to 5th July 2016 by the University, shall be permitted to retain the research scholars who have applied for their registration prior to date of commencement of these Regulations in force. However, registration to research leading to Ph.D. programme shall be allowed under the provisions of these regulations only in Research Centers, fulfilling the requirements specified in Clauses 10.1 and 10.2 of these Regulations.

11. Treatment of Part time Ph.D.

11.1 Notwithstanding anything contained in these Regulations or any other Rule or Regulation, for the time being in force, the University shall not conduct Ph.D. Programmes through distance education mode.

11.2 Part-time research for Ph.D. shall be allowed provided all the conditions mentioned in the extant Ph.D. Regulations are met in full irrespective of part time research or full time research.

11.3 Scholars granted registration shall have to mark attendance in the department/research center concerned for not less than 180 days prior to submission of thesis in not more than three spells as full time research scholar.

12. Award of Ph.D. degrees prior to Notification of these Regulations

12.1 Award of degrees to candidates registered/waiting for registration for research leading to Ph.D. on or after July 11, 2009 till 4th July 2016 shall be governed by the provisions of the UGC(Minimum Standards and procedure for Awards of M.Phil./Ph.D. Degree)Regulation 2009 and subsequent Regulations and guidelines thereof adopted by the University

12.2 Recognition of Ph.D. degree awarded by the Foreign University shall be decided based on the recommendations of the Standing Committee of the Academic Council.

13. Depository with INFLIBNET

13.1 The University shall submit an electronic copy of the Ph.D. thesis to the INFLIBNET, following the successful completion of the evaluation process and before the announcement of the award of Ph.D. degree, for hosting the same accessible to all.

13.2 The University shall issue a separate Certificate to each scholar, prior to the actual award of the Degree, to the effect that the Degree has been awarded in accordance with the provisions of the UGC(Minimum Standards and procedure for Awards of M.Phil./Ph.D. Degree)Regulations 2016.

14. Rules and procedures

The rules and procedures for conduct of coursework/pre-submission presentation/ evaluation of thesis/public viva-voce within the frame work of these regulations shall be framed by the University, giving due consideration to these Regulations.

15. Repeal and Saving

15.1 All directives and orders issued, before the commencement of these regulations, by the University under the then existing regulations and guidelines shall continue to apply for the period for which such orders/ directions were issued. All guidelines issued shall continue to have effect until such rules are rescinded or modified, as the case may be, and save, as otherwise provided in these regulations are hereby repealed.

15.2 In case of disputes, the Vice Chancellor, as the academic head of the University, shall examine the cases individually and take an appropriate decision.

B**2. M.Phil Regulations (2016)**

UNIVERSITY OF KERALA

Abstract: Regulations for award of M.Phil Degrees, University of Kerala, 2016 – Clause 3.1 and 6.3 – Modified – Orders issued.

ACADEMIC A.II.SECTION

No.Ac.A.II/1/22/2017 Dated, Thiruvananthapuram 20.09.2017

Read: 1 U.O No. Ac. A II/2016, Dated 20.08.2016
2 Item No. 81 of the minutes of the meeting of the Academic Council held on 04.10.2016.
3 Item No.II (3) of the minutes of the meeting of the Senate held on 21.02.2017 and 22.02.2017
4 Item No. 63 of the minutes of the meeting of the Academic Council held on 15.04.2017

O R D E R

The Vice Chancellor, vide paper read as (1) above has approved the Regulations for Award of M.Phil Degrees, University of Kerala 2016 being implemented in the University with effect from 05.07.2016. The Academic Council held on 04.10.2016, vide paper (2) above, noted the action taken by the Vice Chancellor in having approved the Regulation for Award of M.Phil Degrees, University of Kerala, 2016 and issuance of the U.O read as (1) above. The Senate, considered the matter vide paper read as (3) above, and resolved to resubmit the same after clarifying the total credits and reconsideration of clauses 3.1, 6.3, and 9.1 of the Regulations with the UGC Regulation, by the Academic Council. The Academic Council vide paper read as (4) above, resolved to modify the Clause 3.1 and 6.3 of the Regulations for Award of M.Phil Degrees, University of Kerala 2016 as follows:

3.1 Candidates for M.Phil. Programme shall be granted admission through an entrance test conducted by the University.

6.3 All courses prescribed for M.Phil. Course work shall be in conformity with the credit hour instructional requirements and shall specify content, instructional and assessment methods duly approved by Academic Committee of CSS in the University and reported to the Academic Council.

In the circulated Regulations for Award of M.Phil Degrees, Clause 6.3 and 6.4 were printed as a single clause, Clause 6.4 read as follows:

6.4 The Department where the scholar pursues research shall prescribe the course(s), based on the recommendations of the DDC, as stipulated under clause 7.1 of these regulations.

The U.O. read as (1) stands modified to this extent.
Orders are issued accordingly.

Sd/ -
SOBHANAKUMARI.K
DEPUTY REGISTRAR (Acad.II),
For REGISTRAR

Regulations for Award of M.Phil Degrees
University of Kerala 2016
(*U.O.*No.Ac.A.II/1/22/2017 dt. 20.09.2017)

Regulations for Award of M. Phil. Degree, University of Kerala, 2016 are framed in supersession of the UGC(Minimum Standards and Procedure for Awards of M.Phil./Ph.D. Degree)Regulation 2009 notified in The Gazette of India [No.28, Part III-Section 4] for the week July 11-July 17, 2009; and in accordance with the UGC(Minimum Standards and Procedure for Awards of M.Phil./Ph.D. Degree)Regulations 2016 notified in The Gazette of India [No. 278, Part III-Section 4] Extra Ordinary on July 5th 2016 vide No.F.1-2/2009(EC/PS)V(I) Vol.II-in exercise of the powers conferred by clauses (f) and (g) of sub-section(1) of Section 26 of the University Grants Commission Act, 1956 (3 of 1956).

1. Short title, Application and Commencement

1.1 These Regulations are titled as ***The Regulations for Award of M.Phil. Degrees, University of Kerala 2016.***

1.2 These Regulations shall come into force with effect from 5th July 2016 and shall be made applicable to candidates seeking admission for M.Phil Degree from 2016 onwards.

2. Eligibility criteria for admission to M.Phil. programme

2.1 Candidates for admission to the M.Phil. programme shall have a Masters degree or a professional degree declared equivalent to the Masters degree by the corresponding statutory regulatory body, with at least 55% marks in aggregate or its equivalent grade 'B' in the UGC 7-point scale(or an equivalent grade in a point scale wherever grading system is followed) or an equivalent degree from a foreign educational institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions.

2.2 A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, may be allowed for those belonging to SC/ST/OBC (non-creamy

layer)/Differently-abled and other categories of candidates as per the decision of the Commission from time to time, or for those who had obtained their Masters degree prior to 19th September, 1991. The eligibility marks of 55% (or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned above are permissible based only on the qualifying marks without including the grace mark procedures.

2.3 Academic Committee of the Credit and Semester System (CSS) of the University shall be empowered to manage and control the evaluation and declaration of results of M.Phil. programmes offered in the University Departments/Centres in lines with the P.G. programmes of University Departments.

2.4 Evaluation and declaration of results of M.Phil. programme offered in the affiliated colleges shall be managed and controlled by the Controller of Examinations in lines with the P.G. programmes of affiliated colleges.

3. Procedure for admission

3.1 Candidates for M.Phil. Programme shall be granted admission through an entrance test conducted by the University.

3.2 The number of M.Phil. scholars, to be admitted to each subject of study at the University Departments/Centers and duly approved research centers, shall be decided based on number of available research supervisors and other academic as well as physical facilities accessible, in accordance with the norms regarding the scholar-teacher ratio (as specified in clause 5.3 of these Regulations), laboratory, library and such other facilities.

3.3 The University shall notify every year in the website and through advertisement (in at least two national newspapers, of which at least one shall be in the regional language) the number of seats for admission, subject/discipline-wise distribution of available seats, criteria for admission, procedure for admission, examination centre(s) and date(s) of entrance test(s) and all other relevant information for the benefit of candidates.

3.4 Admission shall be based on the criteria notified by the University, keeping in view the guidelines/norms in this regard issued by the UGC and other

statutory bodies concerned, and taking into account the reservation policy of the State Government/University, applicable to SC/ST/OBC (non-creamy layer)/differently-abled and other categories of candidates, as decided by the State Government/University from time to time.

3.5 Candidates eligible for registration to M.Phil shall be decided by a two stage process – Entrance Test and Interview.

3.6 Entrance Test shall be conducted at the Centre(s) on the dates notified in advance and changes of centers/dates, if any, shall be notified sufficiently earlier. Syllabus of the Entrance Test shall consist of questions based on research methodology (50%) and the subject of study concerned (50%).

3.7 Interview shall be conducted by the Department Doctoral Committee(DDC) in such a way that the candidates would be required to discuss their research interest/area.

3.8 The University shall maintain the list of all M.Phil. scholars, granted admission for research on its website on annual basis with the details, such as the name of researcher, topic of research, name of supervisor/co-supervisor and date of enrolment.

4. Duration of the Programme

4.1 M.Phil. programme shall be for a minimum duration of two consecutive semesters/one year and the candidates admitted to the programme shall have to complete the programme within a maximum of four consecutive semesters/two years.

4.2 Women candidates and persons with disability (of more than 40% disability) may be allowed a relaxation of one year for M.Phil. in the maximum duration.

4.3 Women candidates may be provided maternity leave/child care leave once in the entire duration of M.Phil. for up to 240 days.

5. Allocation of Research Supervisor

5.1 Any regular Professor of the University/approved research centre with at least five research publications in refereed journals, approved by the UGC/ University and any regular Associate/Assistant Professor of the

University/approved research center with a Ph.D. degree and at least two research publications in refereed journals, approved by the UGC/ University, may be recognized as research supervisor. The scientists on regular employment referred to in clause 5.2 of these Regulations may also be recognized as research supervisors.

Provided that in areas/disciplines where there is no/only a limited number of refereed journals available, the University may relax the above condition for recognition of a teacher/scientist as research supervisor with reasons recorded in writing.

5.2 Scientists in the regular service in research laboratories of Central/State Government, located in the geographical jurisdiction of University, may also be approved as research supervisor/co-supervisor and the scientist in Grade-D, scientist in Grade-E and scientist in Grade-F&G are equated with Assistant Professor, Associate Professor and Professor respectively, exclusively for the purpose of research supervision, subject to fulfillment of other requirements stipulated in these Regulations.

5.3 A Professor as research supervisor/co-supervisor, at any given point of time, shall guide not more than **three** M. Phil. scholars. An Associate Professor as Research Supervisor shall guide up to a maximum of **two** M. Phil. scholars and an Assistant Professor as research supervisor shall guide only **one** M.Phil scholar.

5.4 The DDC concerned, in case of topics which are of inter-disciplinary nature and where the expertise in the Department has to be supplemented from outside, may nominate a research supervisor from the Department itself as the research supervisor, and a research co-supervisor from outside the Department/ Faculty/College/or other Institution on such terms and conditions as may be specified and agreed upon by the consenting Institutions/Colleges and duly approved by the University.

5.5 Teachers/scientists who have retired from the service of the University/ affiliated colleges/approved research institutions, adjunct faculty, visiting faculty, technical staff, library staff, administrative staff, teachers serving outside the geographical jurisdiction of the University and teachers appointed on contract basis shall not be recognized as Research Supervisors

under the provisions of these regulations.

5.6 Allocation of research supervisor for a selected M.Phil scholar shall be decided by the DDC concerned depending on the number of scholars per research supervisor, available specialization among the research supervisors and research interests of the scholars as indicated by them at the time of interview.

5.7 The DDC concerned shall prepare a list of eligible scholars in lines with clause 5.6 of these Regulations and allocate the scholars, in the list, to the research supervisors giving due consideration to research interests of the scholars as indicated by them at the time of interview and willingness of the research supervisor in a meeting specifically convened for the purpose.

5.8 The research data, in case of relocation of the woman scholar for M.Phil. due to marriage or otherwise, shall be allowed to be transferred to the University to which the scholar intends to relocate, provided all the other conditions in these regulations are followed in letter and spirit and the research work does not pertain to the project secured by the parent institution/supervisor from any funding agency. The scholar shall give due credit to the original research supervisor and the institution for the part of research already done.

6. Course Work:

6.1 The course work for M.Phil. shall be of a minimum of 12 credits and a maximum of 16 credits. The M.Phil. dissertation work shall be of 20 credits.

6.2 A minimum of four credits shall be assigned to one or more courses on Research Methodology which shall cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, and field work and other areas found relevant to the discipline concerned. Other courses shall be advanced level areas in the subjects concerned for enabling the students to acquire deep knowledge in the preparation for M.Phil. Programme.

6.3 All courses prescribed for M.Phil. Course work shall be in conformity with the credit hour instructional requirements and shall specify content, instructional and assessment methods duly approved by Academic Committee of CSS in the University and reported to the Academic Council.

6.4 The Department where the scholar pursues research shall prescribe the course(s), based on the recommendations of the DDC, as stipulated under clause 7.1 of these regulations.

6.5 Scholars admitted to the M.Phil. programmes shall be required to complete the course work prescribed by the Department during the initial one year from the date of admission for research, failing which the admission may be cancelled. The reappearance of the scholar for the courses, in which required credits are not secured, shall be permitted within the duration of one year specified.

6.6 Grades in the course work, including research methodology courses, shall be finalized after a combined assessment by the DDC and one external examiner, and the final grades shall be communicated to the Vice Chairman of CSS or Controller of Examinations, as the case may be.

6.7 M.Phil Scholar has to obtain a minimum of 'B' Grade in the UGC 7-point scale in the course work with a minimum of 55% marks in order to be eligible to continue in the programme and submit the dissertation.

7. Evaluation of Dissertation

7.1 M.Phil. Scholar shall, upon satisfactory completion of course work and obtaining the grade prescribed in sub-clause 6.7 above, be required to undertake the research work and produce a draft dissertation within a reasonable time, as stipulated by the University based on these Regulations.

7.2 M.Phil. scholars shall present at least one research paper in a conference/seminar, recognized by the Department Council concerned, before the submission of the dissertation for adjudication and produce evidence for the same in the form of presentation certificates.

7.3 Dissertation submitted for adjudication shall contain an undertaking from the research scholar and a certificate from the Research Supervisor attesting to the originality of the work, vouching that there is no plagiarism using the software approved by the UGC/University and that the work has not been submitted for the award of any other degree/diploma of the University or to any other Institution.

7.4 Dissertation for M.Phil submitted for adjudication shall be evaluated by the

respective research supervisor and one external examiner, who is not in employment of the University.

7.5 The external examiner for evaluation of M.Phil. dissertation shall be appointed by the Vice Chancellor from among the panel of five experts prepared and submitted by the supervising teacher and duly scrutinized by Head of the Department and countersigned by Dean of the Faculty concerned invariably with sufficient modifications, if required, giving due consideration to the topic of specialization.

8. Public Viva Voce

8.1 Public viva voce, based on the observations given in the evaluation report, shall be conducted by a Board consisting of the external examiner, in the duly approved panel nominated by the Vice Chancellor, as Chairperson and the research supervisor concerned as member.

8.2 Public viva voce shall be open to all faculty members of the Department, research scholars and interested experts/researchers/ students.

8.3 Public viva voce of the research scholar to defend the dissertation shall be conducted only if the recommendations in the evaluation report of the external examiner on the dissertation, submitted in the format specified by the University for the purpose, is satisfactory and specific recommendation for conduct of the public viva-voce is made.

8.4 The dissertation shall be sent to another external examiner, contained in the approved panel of examiners, in case the evaluation report of the external examiner is unsatisfactory and does not recommend for conduct of the public viva-voce.

8.5 Public viva-voce examination, in respect of scholars referred to in Clause 8.4 of these Regulations, shall be held only if the recommendation in the evaluation report of the second external examiner is satisfactory.

8.6 The dissertation shall be rejected, in case the recommendation in the report of the second External Examiner is unsatisfactory and the research scholar concerned shall be made ineligible for the award of the degree, based on the dissertation already submitted.

8.7 A scholar who fails in the public viva voce, in the first instance, conducted to ascertain the genuineness of the research shall be required to reappear once for public viva voce within six months but not before three months from the date of conduct of first public viva voce, by remitting the fee prescribed by the University. The recommendations of the Board in the second instance shall be approved by the University and no more chance for public viva voce shall be available to the scholar.

8.8. The University shall formulate appropriate methods, so as to complete the entire process of evaluation of the dissertation for M.Phil. in a time bound manner.

9. Academic, administrative and infrastructure requirement for offering M.Phil. programmes

9.1 Post-graduate Departments of affiliated Colleges and Research laboratories of Central/State Government with at least two Ph.D. qualified teachers/scientists in the Department concerned along with required infrastructure, supporting administrative and research promotion facilities as per these Regulations, stipulated under sub-clause 9.2, shall be considered eligible to offer M.Phil. programmes, provided the other conditions specified by the University are fulfilled.

9.2 Post-graduate Departments of Colleges and Research laboratories of Central/ State Government with adequate facilities for research as mentioned below alone shall be allowed to offer M.Phil. programmes:

9.2.1 In case of science and technology disciplines, exclusive research laboratories with sophisticated equipment as specified by the University with provision for adequate space per research scholar along with computer facilities and essential software, and uninterrupted power and water supply;

9.2.2 Earmarked library resources including latest books, international journals, e-journals, extended working hours for all disciplines, adequate space for research scholars in the Department/Library for reading, writing and storing study and research materials;

9.2.3 Colleges may access the required facilities of the neighbouring Institutions/Colleges, or of those Institutions/Colleges/R&D laboratories/Organizations which have the required facilities.

10. Treatment of Part time M.Phil.

Notwithstanding anything contained in these Regulations or any other Rule or Regulation, for the time being in force, the University shall not conduct M.Phil. Programmes through part-time/distance education mode.

11. Award of M.Phil. degrees prior to Notification of these Regulations

11.1 Award of degrees to candidates admitted for research leading to M.Phil. on or after July 11, 2009 till 4th July 2016 shall be governed by the provisions of the UGC(Minimum Standards and procedure for Awards of M.Phil./Ph.D. Degree)Regulation 2009 and subsequent Regulations and guidelines thereof adopted by the University.

11.2 Recognition of M.Phil degree awarded by the Foreign University shall be decided based on the recommendations of the Standing Committee of the Academic Council of the University.

12. Depository with INFLIBNET

12.1 The University shall submit an electronic copy of the M.Phil dissertation to the INFLIBNET, following the successful completion of the evaluation process and before the announcement of the award of M.Phil. degree, for hosting the same accessible to all.

12.2 The University shall issue a separate certificate to each scholar, prior to the actual award of the Degree, to the effect that the Degree has been awarded in accordance with the provisions of the UGC(Minimum Standards and procedure for Awards of M.Phil./Ph.D. Degree) Regulations 2016.

13. Rules and Procedure

The rules and procedures for conduct of coursework/pre-submission presentation/Inter-disciplinary programmes/evaluation of dissertation/ public viva-voce within the configuration of these regulations shall be framed by the University.

14. Repeal and Saving

14.1 All directives and orders issued, before the commencement of these regulations, by the University under the then existing regulations and guidelines shall continue to apply for the period for which such orders/ directions were issued. All guidelines issued shall continue to have effect

until such rules are rescinded or modified, as the case may be, and save, as otherwise provided in these regulation s are hereby repealed.

14.2 In case of disputes, the Vice Chancellor, as the academic head of the University, shall examine the cases individually and take an appropriate decision.

Sd/-
REGISTRAR

B3. Guidelines on Ph.D/M.Phil (2016)

UNIVERSITY OF KERALA

(Abstract)

Guidelines for implementing UGC Minimum Standards and Procedures for award of M.Phil. / Ph.D. Degree - Regulations, 2009 - Sanctioned Orders issued.

ACADEMIC E.1 SECTION

Ac.E1/2016 **Dated, Thiruvananthapuram 01/02/2016**

Read: U.O.No.Ac.E1/2015 dated 08/01/2016.

O R D E R

Sanction has been accorded by the Vice-Chancellor to the Guidelines as below, framed in conformity with the **UGC Minimum Standards and Procedures, 2009** being followed for implementing the regulations for the award of M.Phil. /Ph.D Degree by the University of Kerala.

1. Introduction

1.1 The Secretary, University Grants Commission has informed Vice Chancellors of all the Universities that some of the Universities are circumventing the provisions of UGC Minimum Standards and Procedure for Award of M.Phil./ Ph.D. Regulations, 2009 in matters related to Qualifications of Research Supervisors and the procedure for evaluation of research reports.

1.2 It has been intimated by the UGC that in case of any Aberration to the UGC Minimum Standards and Procedure for Award of M.Phil / Ph.D., it will be proceeded against as per the UGC Act, 1956 and the name of University will be put in the defaulters list on the UGC website.

1.3 The UGC Regulations, 2009 insist that along with the Research Degree, the University shall have to issue a separate certificate to the effect that the Degree has been awarded in accordance with the provisions of the UGC Regulations.

1.4 The Deans' Council referred to in these guidelines elsewhere is the academic Body consisting of Vice Chancellor, Faculty Deans and the Registrar (Convener) of the University.

2. Research Supervisor

2.1 The University shall allocate only regular faculty members in the teaching Department or the affiliated PG Colleges/Institutes as Research Supervisors

2.2 Each Research Supervisor shall not have, at any given point of time, more than eight Ph.D Scholars and five M.Phil Scholars.

2.3 The number of seats for M.Phil. and Ph.D. shall be decided well in advance and notified in the University website or advertisement on the basis of the data furnished by the Heads of Departments of University Departments and Heads of Approved Research Institutions.

3. Procedure for Admission

3.1 The University shall admit M.Phil students through an Entrance Test conducted at the University level. However, the Universtiy shall decide separate terms and conditions for those students who qualify UGC/CSIR. (JRF) Examination /SLET/GATE/Teacher Fellowship -holder. Similar approach shall be adopted in respect of Entrance Test for Ph.D Programme.

3.2 The candidates applied for admission /registration shall be interviewed by the University Department/Institution, as the case may be.

3.3 The candidates are expected to suggest and discuss their research interest /area at the time of Doctoral Interview held for selection to registration.

3.4 The Department /Approved Research Centres shall pay due attention to the state Reservation Policy in force, while granting admission to the M.Phil/Ph.D.Programmes.

4. Allocation of Research Supervisor

4.1 Allocation of the supervisor for a selected scholar shall be decided by the Department in a formal manner depending on the number of scholars per Faculty member, the available specialization among the faculty supervisors, and The research interest of the scholar as indicated during interview , by the scholar.

4.2 The allotment/allocation of supervisor shall not be left to the individual scholar or teacher :

5. Coursework

5.1 Each M.Phil./Ph.D. Scholar, after having been admitted, shall be required by the University, to undertake course work for a minimum period of one semester.

5.2 The University shall decide the minimum qualifying requirements for allowing a Student to proceed further with the writing of the dissertation /thesis

6. Evaluation and Assessment

6.1 Each Scholar shall undertake the research work and produce a draft dissertation / Thesis within a reasonable time, as stipulated by the University, upon satisfactory completion of the course work, which shall form part and parcel of the M.Phil./Ph.D. Programme.

6.2 Prior to submission of the thesis, the scholar shall make pre-M.Phil./Ph.D. Presentation in the Department that may be open to all faculty members and research scholars with a view to obtaining feedback and comments and such feedback and comments obtained shall be suitably incorporated into the draft thesis under the advice of the research supervisor.

6.3 Ph.D. Scholars shall publish at least two research papers in a referred journal bearing ISSN before the submission of the thesis for adjudication, and produce evidence for the same in the form of acceptance letter or the reprint.

6.4 The dissertation produced by the M.Phil. Scholar in the approved Institutions/ Departments and submitted to the University as the case may be, shall be evaluated by two experts, out of which at least one shall be from outside the University.

6.5 The thesis produced by the Ph.D. Scholar in the approved institutions/Departments and submitted to the University, as the case may be, shall be evaluated by three experts, out of which at least two shall be from outside the State.

6.6 The three experts for evaluation of Ph.D. thesis shall be appointed by the University from a panel of experts prepared and submitted by the Supervising Teacher and duty countersigned by the Head of the University Department/ Chairman PG Board of Studies in the subject concerned and endorsed by the Faculty Dean.

6.7 The M.Phil. Scholar shall undergo viva voce on receipt of satisfactory evaluation reports.

6.8 The Ph.D. scholar shall undergo an open defence cum via voce, on receipt of satisfactory evaluation reports.

6.9 The open defence cum via voce shall be conducted by a Board consisting of one of the External Examiners nominated by the Vive Chancellor, Dean of the Faculty concerned, Head of the University Department concerned and the Research Supervisor. The

External Examiner shall serve as the Chairman and the Research Supervisor as the Convener of the Board.

7. Conduct of open defence cum viva voce

7.1 The presence of all approved research guides and research scholars concerned shall be ensured at the open Defence by the Heads of University Departments/Approved Research Centres.

7.2 The minimum number of genuine participants for the conduct of open defence shall be 25 and the genuine participants for this purpose would be the approved research guides and research scholars in the subject of study concerned.

7.3 The Heads of University Depatments/Approved Research Centres shall have to forward the attendance statements with the countersignature of the Faculty Dean, so as to ensure the participation of genuine invites as mentioned in clause 7.2 of these guidelines.

7.4 Absence of research scholars in the open defence without prior permission shall h ave to be viewed seriously by the Heads of Departments, since the research scholars are the real beneficiaries of the open defence with their active participation in the discussions.

7.5 Each department shall have to maintain an updated list of email addresses of the invitees and the invitation is to be extended by the supervising teacher concerned by email, attaching the synopsis.

8. Conduct of Pre-Submission presentation

8.1 The Pre- Submission presentation shall be conducted by a Board consisting of one of the External Experts nominated by the PVC from the panel forwarded by the Head of Departments; Dean of the Faculty concerned: Head of University Department concerned and the Research Supervisor. The Head of the Department shall serve as the Chairman and the Research Supervisor as the Convener of the Board.

8.2 The deliberations of Pre-Submission presentation of each thesis for the award of Ph.D. Degree are to be made meaningful for improving the quality of the work.

8.3 The presence of approved research guides and research scholars concerned are to be ensured by the Head of Departments for the Pre-Submission in the same manner as that of open defence.

9. Miscellaneous matters

9.1 There shall be no change in the existing procedures for submission of application for change of Research Supervisors in respect of the research candidates who are already granted registration by the University.

9.2 The Research Supervisors who retire from service on attaining superannuation from 2015-2016 academic year onwards shall be permitted to continue the guidance for one year from the dare of retirement to complete the research work of the then existing research scholars.

9.3 The existing Research Supervisors who have retired from service, but not covered under clauce 9.02 of these guidelines shall be permitted to continue the guidance and complete the research work of the existing research scholars before 15th july 2016.

9.4 The departmental Doctoral Committee shall have to reallocate the candidates working under the guidance of research supervisors already from service and not covered under Clauses 9.02 and 9.3 of these guidelines.

9.5 All the Research Supervisors already approved by the University inclusive of retired teachers shall be permitted to continue as co-supervisor of the existing research scholars.

9.6 The Departmental Doctoral Committee shall forward further recommendations for registration to new candidates, only after regularizing of existing scholars through reallocation of research supervisors, wherever found necessary.

9.7 Each Research Supervisor referred to in Clause 2.1 of these guidelines shall be granted two supernumerary seats, If found necessary, for accommodating the existing research scholars on reallocation, and such supernumerary seats shall be regularized against the subsequent vacancies arising on submission of thesis/ cancellation of registration.

9.8 Grievances of the existing research scholars/ supervising teachers on matters not referred to in these guidelines shall be individually addressed and the decisions on such issues shall be taken by the Vice Chancellor in constitution with the Deans' Council, wherever found necessary.

9.9 The procedure and methods, other than those specifically mentioned in these guidelines, shall be dealt with by adhering to the existing guidelines/ conventions.

B4. Anti-Plagiarism Policy

(Adopted by Academic Council on 15th April 2017)

UNIVERSITY OF KERALA
(Abstract)

Policy document on Anti-plagiarism- adopted- from 2017 July session of M.Phil/Ph.D -approved - orders issued

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ACADEMIC A.II SECTION

No.Ac.A.II/14/ 2017 Dated, Thiruvananthapuram 01.07.2017

References

1 Report of 'Statistical Study on observed range of similarity of content with other sources, in PhD thesis accepted by University of Kerala and to prepare a limit for Plagiarism'- Preapared & Submitted by the Dean, Faculty of Applied Sciences and Tenhnology.

2 Item No. 25 of the Standing Committee of the Academic Council held on 20/3/2017

3 Item No.72 of the Minutes of the Meeting of the Academic Council held on 15/04/2017

O R D E R

Vide paper read as (1) above, Dean, Faculty of Applied Sciences and Technology prepared and submitted the policy document on Anti-Plagiarism based on *'Statistical Study on the observed range of similiarity of content with other sources, in PhD thesis accepted by University of Kerala and propose a limit for Plagiarism'*. The Standing Committee of the Academic Council vide paper (2) above considered the item and recommended that the draft policy document, applicable to P.G, M.Phil and Ph.D, be approved with minor modifications and placed before the Academic Council for decision.

The Academic Council, at its meeting held on 15/04/2017, approved the draft policy document on Anti-Plagiarism , excluding the P.G courses from the purview of the Policy.

Sanction has been accorded by the Vice Chancellor to adopt the policy document as modified and approved by the Academic Council and implement with effect from July 2017 session of M.Phil/Ph.D. [The Anti-Plagiarism Policy document is appended.].

Orders are issued accordingly.

Sd/-
SOBHANAKUMARI. K
DEPUTY REGISTRAR (Acad.II)
For REGISTRAR

The University of Kerala declares through this policy statement that academic dishonesty of any manner is unacceptable and that the University would continuously strive to create and maintain awareness about it and any such unfair practice detected would be subjected to serious consequences.

Towards this, the University of Kerala shall

- *Provide a framework for the development of a research culture, making it unacceptable to use content (textual or other forms) not owned by the author, without citing sources / with or without paraphrasing or adoption;*
- *Promote research activities, in such a way as to improve the quality of work and sustainability, by putting an end to the use of large chunk of content from external sources;*
- *Contribute towards to preventing unfair practice of cooked up results of surveys or experiments without actually carrying surveys / experiments;*
- *Prevent supportive for terminating any form of dishonest, misleading, fraudulent, inauthentic and inappropriate academic reporting; and*
- *Develop an academic ethos that generates and promotes innovation, free of any academic dishonesty innovative techniques.*

The following guidelines are framed for implementing the Anti-Plagiarism policy of the University which shall be made applicable to the project reports/ dissertations/theses submitted to the University for Award of MPhil/PhD degree respectively from 1st January 2017 onwards.

- The University of Kerala shall not tolerate plagiarism in any manner and for this purpose accepted limit shall be zero per cent.
- The project/research supervisor and HoD shall be responsible for creating awareness among candidates falling under the purview of these policy guidelines on the consequences of plagiarism in the research reports submitted to the University.
- Every University Department/ Approved Research centre shall arrange the conduct of awareness lectures on the consequences of plagiarism in the research reports submitted to the University at least once in a year and maintain attendance register of participants in the Department.
- The Dept. Doctoral Committees shall be responsible for scrutiny of the project reports/ dissertations/theses submitted to the University for Award of PG Diploma and Masters/MPhil/PhD degree respectively
- The students/researchers shall have to produce evidence of verification of "overlap with other sources" using UGC recommended URKUND software.

- The overlap with other sources shall not exceed 10 per cent in the report, submitted for evaluation, exclusive of references.
- Overlap of less than 10 per cent does not make the research report 'plagiarism free' and as such the research supervisor and DDC shall have to ensure in each case through scrutiny that the Anti-Plagiarism policy of the University to maintain the accepted limit of zero per cent is upheld
- In respect of Research reports written in non-English Text, wherein URKUND software may not be employed for evaluation of overlaps, manual evaluation shall have to be relied on and approximate quantification shall have to be attempted by the research supervisor and DDC concerned.
- Plagiarism, if any, brought to the notice of the University by the examiner(s) or a genuine/well-founded source shall be investigated in detail through a committee consisting of the respective Dean of the Faculty, Head of the Dept/Chairperson of the BoS, two external experts at the level of professors from outside the University, nominated by the Vice-Chancellor. Of the two external experts, at least one shall be from outside the State.
- The committee shall provide reasonable opportunities to the respective student/researcher and guide to be heard in person and shall seek their written statements before arriving at conclusions.
- The committee shall make specific recommendation on the extent of plagiarism as ***'not existing' /' minor'/ 'major'***.
- In case of minor plagiarism, the candidate shall be imposed a fine, as decided by the University from time to time and shall be directed to resubmit the dissertation/report, with appropriate modifications.
- If case of major plagiarism, the matter shall be brought to the notice of the Academic Council and subsequently to the Senate for a decision inclusive of the withdrawal of degree/ diploma, in accordance with the provisions contained in the Acts and Statutes of the University of Kerala.


Why Sacrifice Your Life and Career For a Criminal and Uncultured behaviour towards a fellow student ?
നാട്ടകം പോളി റാഗിങ്: മൂന്ന് വിദ്യാർഥികൾകൂടി അറസ്റ്റിൽ
നാട്ടകം: നാട്ടകം ഗവ.പോളിടെക്നിക് കോളേജിൽ ഒന്നാം വർഷ വിദ്യാർഥികളെ റാഗ് ചെയ്ത സംഭവത്തിൽ തിങ്കളാഴ്ച മൂന്ന് സീനിയർ വിദ്യാർഥികൂടി അറസ്റ്റിലായി. ഒരാളെ അന്വേഷണസംഘം അറസ്റ്റ് ചെയ്യുകയും രണ്ടുപേർ കീഴടങ്ങുകയും ചെയ്തിരുന്നു.
എസ്.പി ഓഫിസിൽ കീഴടങ്ങിയിരുന്നു. കോളേജ് ഹോസ്റ്റലിൽ റാഗിങ്ങിനു വിധേയരായതായി ഒന്നാം വർഷ മെക്കാനിക്കൽ വിദ്യാർഥികളായ തൃശൂർ ഇരിങ്ങാലക്കുട സ്വദേശി അവിനാഷ്, എറണാകുളം സ്വദേശി ഷൈജു പി. ഗോപി എന്നിവർ നൽകിയ പരാതിയിലാണ് കേസ്.
പട്ടികജാതി വിഭാഗത്തിൽപ്പെട്ട വരാണ് ഇവർ. ഇരുവരെയും നഗ്നരാക്കി ക്രൂരമായ വ്യായാമമുറ ചെയ്യിപ്പിക്കുകയും മദ്യം കുടിപ്പിക്കുകയും ചെയ്തതായാണ് പരാതി. പട്ടികജാതി പ്രതിരോധ നിയമവും, റാഗിങ് നിരോധന നിയമവും കേസെടുത്തിട്ടുണ്ട്.
21 വിദ്യാർഥികൾക്ക് സസ്പെൻഷൻ
മഞ്ചേരി: മഞ്ചേരി മെഡിക്കൽ കോളേജിലെ ഒന്നാംവർഷ വിദ്യാർഥികളെ റാഗിങ് നടത്തിയതായി പരാതി. പരാതിയുടെ അടിസ്ഥാനത്തിൽ കോളേജ് മാനേജ്മെൻറ് രണ്ടും മൂന്നും വർഷക്കാരായ 21 വിദ്യാർഥികളെ സസ്പെൻഡ് ചെയ്തു.
ഇവരോട് ഹോസ്റ്റലിൽനിന്ന് വിട്ടുനിൽക്കണമെന്നും കാമ്പസിൽ പ്രവേശിക്കരുതെന്നും നിർദേശിച്ചു. ഇവരുടെ രക്ഷിതാക്കളെ തിങ്കളാഴ്ച
SAY NO TO RAGGING
REPORT RAGGING
1800-180-5522
UNIVERSITY OF KERALA
Nodal Officer, Anti-ragging
Dr. Madhukumar R.,Controller of Examination
University of Kerala, Thiruvananthapuram..
9446567805
Anti-Ragging Committee
Vice-Chancellor
DYSP, (Attingal)
The Deputy Police Commissioner Tvpm
Dr. Sony George, (Chemistry)
Dr. Thajudeen A.S (Arabic)
Dr. B. Mini Devi, (Library & Information Science)
Dr. S. Prema, (Linguistics)
Sri. N.J Nair (The Hindu),
Dr. Sabloo Thomas (Deccan Chronicle)
Sri. V.S Rajesh (Kerala Kaumudi)
Smt. Sugatha Kumari (NGO)
Sri. Udayakumar J (NGO)
Representative of Freshers: Ms. Athira. T
Representative of Senior Students: Sri. Arun Vivek V
Warden, (Women's Hostel, Kvtm)
Warden (Women's Hostel, Thycaud)
Joint Registrar, Kvtm.
Anti-Ragging Squad
Vice-Chancellor
Warden (Men's Hostel Kvtm),
Warden (Women'sHostel, Kvtm)
Warden (Women's Hostel, Thycaud)
Security Officer, Kvtm
Joint Registrar, Kvtm
Staff Advisor (Dept.'s Union)
Staff Advisor (Research Union)
Dr. P.M. Radhamony
Dr. Abdul Salim. A
Director Research
Security Officer (University Office)
Dr. T.S Anirudhan
Dr. Madhukumar R., (CE),Nodal Officer
Monitoring Cell on Ragging
Vice Chancellor
Pro-Vice-Chancellor
Registrar
DCDC
Dr. A. Ganga Prasad (Member, Senate)
Dr. Madhukumar R.,(CE),Nodal Officer
Dr. G.S. Jayasree (Centre for Women's Studies)
Chairperson (Kerala University Union)
Dr. Ampotti A .K (Member, Senate)
Let us all unite to make our campus Ragging free

UNIVERSITY OF KERALA
(Abstract)

Conducting Doctoral Committee for foreign students through electronic media in case of candidates residing outside India-Approved -Orders issued

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ACADEMIC 'D' SECTION

No. Ac D/2/2017 Dated, Thiruvananthapuram,20 .11.2017

Read:-

1. *Item No: 7 of the minutes of the meeting of the Executive Committee of the Centre for Global Academics (CGA) held on 14/08/2017 as approved by the Vice-Chancellor subject to reporting to Syndicate.*
2. *Item No: 30.26.07 of the minutes of the meeting of the Syndicate held on 10.10.2017.*

ORDER

Consequent to the implementation of UGC (Minimum Standards and Procedure for Award of M.Phil/Ph.D Degrees) Regulations, 2016, foreign students seeking registration to do research work leading to award of Ph.D shall have to appear before the Doctoral Committee in person for allotment of Research Guide and approval of Research Topic.

The availability of Research Guide in a particular subject complying with the UGC norms in this regard can be decided only by the Doctoral Committee. There are chances for denial of the admission to Ph.D course after attending Doctoral Committee due to non availability of qualified research guides and also due to saturation of the maximum number of research scholars that a Research guide can accommodate as per UGC norms. As the personal appearance of the candidate for Doctoral Committee is mandatory, the above situation often leads to inconvenience for the foreign students and unnecessary financial expenses.

The Executive Committee of the Centre for Global Academics at its meeting vide paper read as (1) above considered the above mentioned difficulties faced by the foreign students and recommended to conduct the Doctoral committee through electronic media in case of students residing outside India . The above recommendations of the Executive Committee of the CGA was approved by the Vice-Chancellor in exercise of the powers of Syndicate vested under section 10(13) of the Kerala University Act 1974, subject to reporting to Syndicate. The matter was reported to Syndicate vide paper read as (2) above.

Sanction has been accorded by the Vice-Chancellor to conduct the Doctoral Committee through electronic media in case of foreign students residing outside India.

Orders are issued accordingly.

Sd/-

Shila Beevi.N
Deputy Registrar (Acad.III)
For Registrar

B5.Green Charter

ALL RESEARCH SCHOLARS NEED TO COMPLY WITH THE GREEN CHARTER FOR PRE- SUBMISSION SEMINARS & OPEN DEFENCES

The Green Charter of University of Kerala envisages priorities aimed at, within constraints, the finest accord with nature.

Through education, research and extension services, the University shall promote the principles and practices for sustainable development, especially the 6R's (Reduce, Reuse, Recycle, Refuse, Rethink and Respect)

The University shall seek to address the Global issue through local specific actions and through the creation of a knowledge society thereby striving for environmental education and conservation

In each and every aspect -academic, research, extension or administrative - the University community shall revolve on the Green Axis.

The University shall issue client specific Green Schedules of Dos and Don'ts for each stake holder. Use of plastic and other polluting substances would be discouraged and that of Green products would be highly encouraged.

A culture of segregation and recycle would be encouraged. A paper recycling unit and facility for producing value added products shall be installed for making use of the waste papers including expired answer scripts with the help of Kudumbashree

University shall make all efforts to popularize ethnic foods and beverages and discourage the junk ones.

An outlet selling ethnic drinks including sarbath, buttermilk, fresh juice, lime juice etc would be opened in the campus in association with Kudumbashree.

To combat the menace of bottled water, water purifiers would be placed in all buildings or floors based on population density and accessibility.

Monoculture of Acacia in Kariavattom Campus shall be gradually replaced with a variety of trees aimed at preserving and enhancing the biodiversity of the Campus.

E-governance drive shall be initiated to reduce the use of paper. At the same time, awareness would be created about carbon emission associated with emails, search engines and social networking facilities.

Uniform dust bins with Green Messages shall be placed in every nook and corner with CSR support.

All new buildings shall be constructed as Green buildings, which minimize artificial lighting and air-conditioning.


Avoid
Plastic Carry Bags
Plastic Cups
Bottled Water
Thermocol Plates
Ball Point Pens
Plastic clad reports/ assignments
Plastic clad Bouquets
Junk Food
Flex Banners
Plastic Mementoes
Promote
Ethnic alternatives in food,
Decorations& utensils
Respect Nature
Refuse
Reduce
Reuse
Recycle
Rethink
Non- green products
Go Green...
UNIVERSITY OF KERALA
कर्मणि व्यज्यते प्रज्ञा
See University's Green Charter
www.iqac.keralauniversity.ac.in

Part C: Learning Resources & Infrastructure

- **Kerala University Library System**
- **Computer Centre& Campus Computing Infrastructure**
- **Sophisticated Instrumentation & Computation Centre**
- **Department-wise Research Infrastructure**
- **Special Facilities in Dept. of Botany**
- **University Museums, Gardens etc.**

C1. Kerala University Library System

1. Kerala Univesity Library

The Kerala University Library, formerly the Library of the University of Travancore, was established in 1942. The present library building, having a total plinth area of 75283 Sq.feet (6994 Sq. meter), started functioning on 8th September 1962. To begin with, the Library, when established, was placed under the administrative control of the Superintendent of Publications who was given the designation of Officer-in-Charge of the Library. In 1959, the post of professional librarian to be in full administrative charge of the Library was created and Prof. K. A. Issac, Librarian of the Forest Research Institute

and College, Dehra Dun, was appointed to the post in August 1959. He was succeeded by Sri. K.C. John from 1980, who had retired in 1989. After his retirement till date (2017), the library is headed by the senior most Deputy Librarian. The present University Library System consists of the Kerala University Library at Palayam, the Campus Library and the 42 Department Libraries at the Kariavattom Campus and many other libraries including that of Lexicon, ICKS, UITs, UIMs, KUTEC's, UCK and the three Study Centre Libraries at Alappuzha, Pandalam and Kollam.

Statistics of Membership			
Sl. No.	**Membership Category**	**Joined in 2016**	**Total**
1	Students of Affiliated Colleges/ UIT /UIM / KUTEC / UCK	3769	12307
2	Students of Teaching departments	378	5145
3	Research Scholars	547	2375
4	Teachers	195	656
5	Non-Teaching staff of University	27	130
6	Kerala Uty Library Staff	2	78
7	Eminent Scholars	4	5
8	Graduate Public	1894	7286
9	Others		
	Retired University Staff	7	18
	Retired University Teacher	1	2
	Central University	9	52
Total		**6833**	**28054**

Total Seating Capacity of the Kerala University Library is 600. Working Hours are from 8 am to 8 pm (Week days), and 2pm to 8 pm (Sundays).

The Kerala University library system has over 8.5 lakhs of books with 3.2 lakhs in the Central Library. These cover the entire range of knowledge spectrum and is easily the best library resource in Kerala. Its special collections are unique and internationally sought. It has 246 print journals, 6000+theses and 20,000+ e-journals for its users. UN and World Bank Collections, specialised indexes produced regularly by the library are value-adds. To promote readership, awards have been distributed to best library user and 35 User orientation programmes have been held.

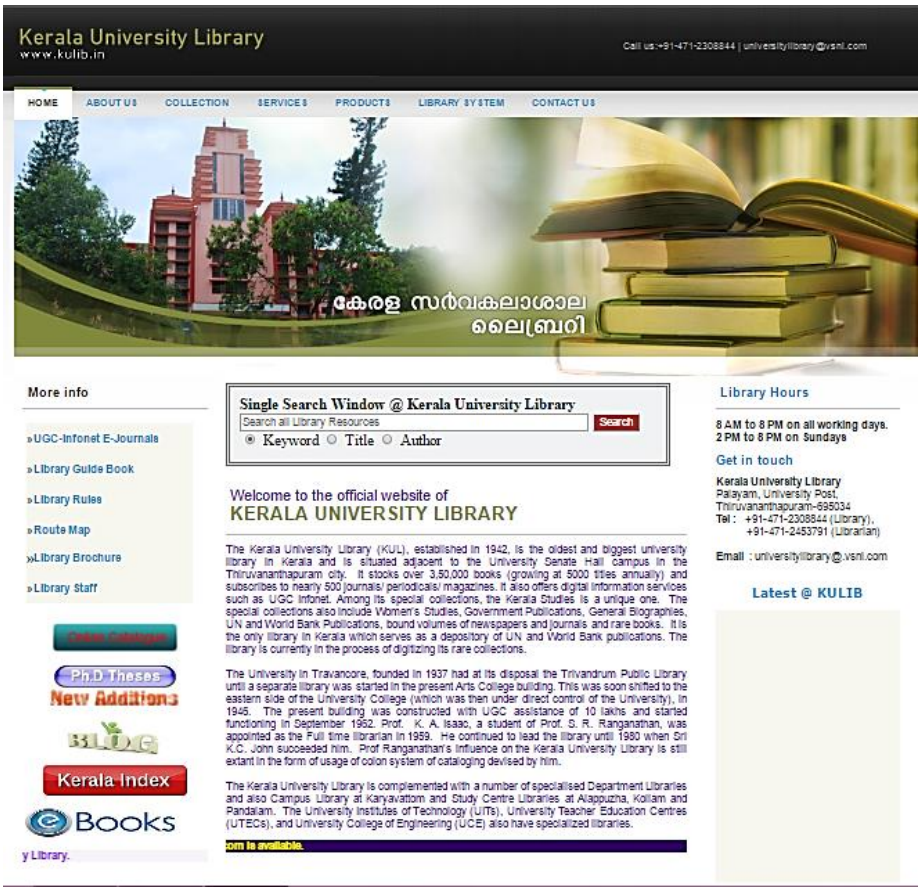
Organization of the library: For functional convenience, the library is divided into 11 sections- Circulation Section, Acquisition section, Technical section, Reference section, Periodical section, Documentation and Information Services section, The Knowledge Resource Centre, Kerala Studies Section, UN & World Bank Section, Research Section, and Maintenance Section (Stack Room).

Property Counter: Members are advised to keep their personal belongings including handbags, hats, attaché cases, printed materials, umbrellas etc in the Property Counter which is on the right side of the entrance. Members will be given a token for keeping their personal belongings which can be taken back on production of the token. Personal belongings kept in the Property Counter have to be taken back on the same day itself and if it is kept beyond one day necessary service charges as fixed by the University has to be paid.

Security Desk: Members have to show their membership card at the security desk and sign the Gate Register at the time of entering the library. Members are requested to hand over the book issued on loan and the token to the security staff on duty. All materials including files, note books etc taken inside the library are to be given for inspection by the security staff when leaving the library.

Membership Desk: Enrolment of membership can be done at the Membership Desk from 8 AM to 1 PM and 2 PM to 7.30 PM. Clearance Certificates will be issued for Membership withdrawn/Closed. Temporary Memberships are also issued on payment or permission issued by the University Librarian/Deputy librarian/Senior most library staff on duty. Smart card was introduced in 2013 as a preliminary step towards introduction of RFID technologies in the Library.

Electronic Resource Centre: The Electronic Resource Centre of the Kerala University Library was established with the objective of providing IT oriented information services to the user community. The IT section is looking-after the automation work of the Library and maintains and updates various databases such as books, theses, back volumes of periodicals etc. LIBSYS-4 software is used for automating different housekeeping operations of the Library. All sections of the library are being interconnected through a Local Area Network (LAN). Kerala University Library website is also maintained by this section. The Kerala University Library Electronic Resource Centre, through UGC Infonet programme, provides access to more than 10,000 electronic journals and 6 other databases accessed through the Electronic Resource Centre



On-line Public Access Catalogue (OPAC): The On-line electronic version of the catalogue is being maintained by Electronic Resource Centre. This facility is available in all the sections of the library and to the public through the library website (www.kulib.in). Wi-Fi facility has also been established in the library to enhance accessibility of information. World Bank E-Library service is also provided.

Kerala Studies Collection: A rare collection of books related to Kerala is maintained by the University Library. These have been digitized partially and available in the library computer system for Google-like search, through the LIDAS software.

Acquiring New books: Students may request their teachers to recommend books of their choices to be purchased in KUL or CL. Based on recommendations of the teachers, and with approval of book purchase committee, such requests are processed.

The utility of the library system is enhanced by the following access and search enablings:

- Open Public Access Catalogue (OPAC) is available at koha.keralauniversity.ac.in:8040 for accessing the University collections catalogue from anywhere in the world.
- Internet bandwidth has been upgraded to 1 GBPS in the library.
- LIDAS, a specialized software custom made for searching digital archives of Kerala Studies collection, is available to users for effective search.

- Digitization of documents is continuously ongoing. 2643 PhD theses are digitized and uploaded in Sodhganga. 11 lakh pages of Kerala Studies collection are also digitized.
- DELNET digital resources have been made available.
- ONV and Vishnu Narayanan Nampoothiri Bibliography have been added.
- Four issue of 'Kerala Index' has been made online.

Library Books & Journal Subscribed

Sl. No	Department	Books	Journals
1.	University Library	342648	194
2.	Campus Library, Kariavattom	23260	95
3.	Aquatic Biology and Fisheries	5868	15
4.	Arabic	8879	N
5.	Archaeology	4009	N
6.	Biochemistry	3653	10
7.	Biotechnology	2700	8
8.	Botany	9399	10
9.	Chemistry	4863	7
10.	Commerce	8036	11
11.	Communication and Journalism	5386	5
12.	Computational Biology & Bioinformatics	3014	N
13.	Computer Science	4375	0
14.	Demography	7305	2
15.	Economics	14357	8
16.	Department of Education	18779	1
17.	Environmental Sciences	1840	2
18.	Future Studies	4063	9
19.	Geology	4781	3
20.	German	11622	0
21.	Hindi	12545	5
22.	History	12551	0
23.	Islamic Studies	6429	14
24.	Law	4639	5
25.	Library and Information Science	5093	11
26.	Linguistics	10122	6
27.	Malayalam	72272	12
28.	Mathematics	7273	2
29.	Music	2683	1
30.	Nano science and Nanotechnology	1038	N
31.	Opto Electronics	3060	8

32.	Philosophy	3632	4
33.	Physics	7467	7
34.	Political Science	21514	20
35.	Psychology	7889	4
36.	Russian	15700	0
37.	Sanskrit	16181	N
38.	Sociology	8452	11
39.	Statistics	10245	10
40.	Tamil	27613	10
41.	Zoology	5927	11
42.	Institute of English	14852	9
43.	Institute of Management in Kerala	14750	7
44.	ORI & Manuscripts Library	15206	8
45.	School of Distance Education	22886	9
46.	ICKS	11637	7
47.	Study Centre Library, Alappuzha	4400	0
48.	Study Centre Library, Kollam	4784	1
49.	Study Centre Library, Pandalam	1578	1
Total		**841255**	**563**

Number of high impact factor journals more than 2.0: 366

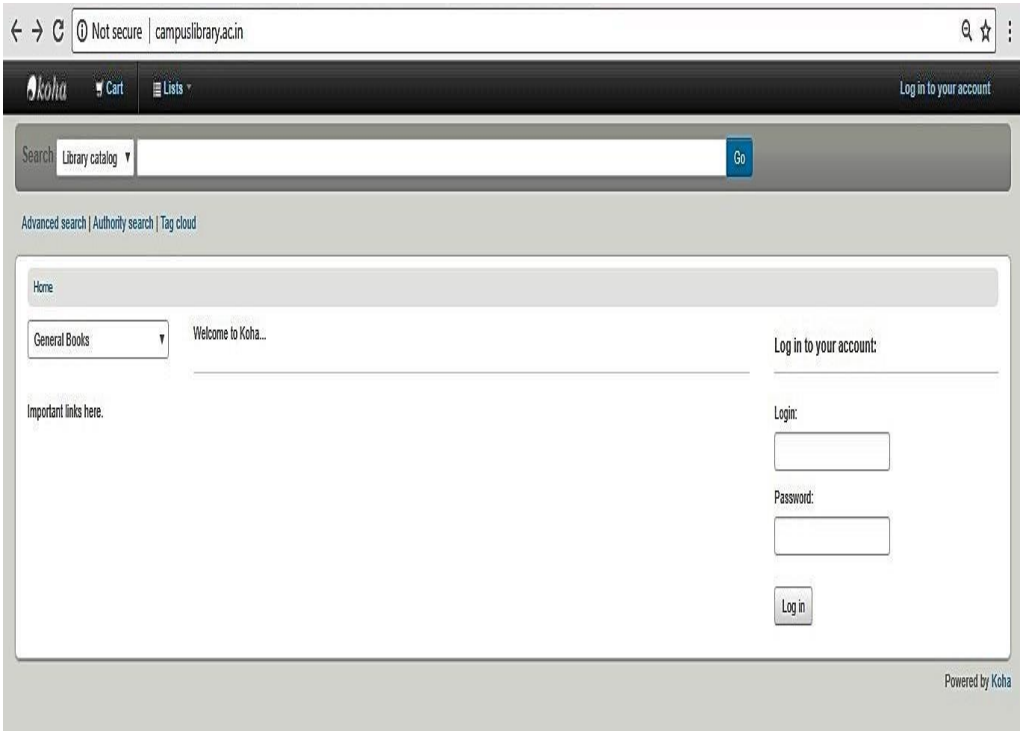
2. Campus Library at Kariavattom

Campus library, established in 1976, acts as a hub of knowledge sharing for all the teaching and other Departments and Centers in the Karyavattom campus. It functions as a Reference Library, in three shifts from 8 AM to 12 Midnight w.e.f. 01.04.2014. It is the first Library in Kerala to open its doors for users for a span of 16 hours without break. A team of professionally qualified staff and administrative personals, led by to the Deputy Librarian, manages the library. The Library holds more than 24000 books, 50 subject periodicals, 50 popular current periodicals and career magazines, and 23 newspapers in English, Malayalam &Tamil. Back issues of subject journals are kept as bound volumes. University subscribes the most demanded e-journals like IEEE, Pro Quest, Indianjournals.com, Scifinder, J-gate etc. and share UGC- infonet consortium. Also a good number of e-books of different publishers are procured. All these are made accessible on IP based search for users in Kariavattom Campus. Wi- Fi Connectivity is available in the campus library.

The library has following sections: (1) Acquisition Section: Book ordering, purchasing and accessioning are handled by this section. The average number of books purchased per year is, approximately, 700. (2) Reference Section: A separate section for Reference Books is housed in the first floor. It is a fully air conditioned hall capable of accommodating 40 students at a time.(3) Researcher's e-learning Centre: 30 seated Computer Lab exclusively for PhD and M-Phil students is functioning in the ground floor. (4)Career Development Area: Large number of reading materials were procured and arranged for the competitive career development purposes. (5) Maintenance Section:

Books in different subjects are arranged according to the Dewey Decimal Classification scheme. (6) Technical Section: Cataloguing and Classification process is done using KOHA Software. Simultaneously, card cataloguing system is maintained for the access of the users. (7) Reprographic Service: The Photocopying service available in the Campus

Library is widely used by the students of the Campus with minimum charge @ 50 paise.



C2. Computing Centre and Campus Computing Infrastructure

1. Kerala University Computer Centre

Computer Centre of the University of Kerala in the senate house in Palayam was setup in 1977 for providing computer facilities for the research activities in the university. Being the only centre in South India with mainframe computing facilities, it attracted researchers from far and wide. In the present IT era, the centre has repositioned itself as a software development centre catering to the needs of the higher education sector. It has took up new challenges in the field of IT enabling of University administration. The centre meticulously follows the principles of business process redesign as a prerequisite of IT enabling.

Computer Centre started functioning on a moderate scale with an IBM-1620, a Second generation computer donated by Vikram Sarabhai Space Centre (VSSC). A third generation 16-bit machine TDC-316 manufactured by M/s Electronics Corporation of India Ltd, Hyderabad was acquired during March 1977. During January 1994, facility for e-mail was established through ERNET. A website of the University was launched on a trial basis during 1997 and by 2001 had grown to a full-fledged site presently available at www.keralauniversity.ac.in.

Computer Centre has undertaken different computerization activities to help the administration and finance activities. Tabulation sections of all examinations of the University make use of custom made software developed by Computer Centre. The Web applications developed by Computer Centre help different examinations sections to allow students register for examinations online. Computer Centre has designed and implemented an intranet in the University campus for use by different wings, for information sharing. WiFi networks for Palayam and Kariavattom campuses have been established and modern Data Centre at Palayam are in progress.

The services provided by Computer Centre are:

- Support for systems analysis, code development and computing services to users.
- Computerization of academic, administrative, examination and financial operations of the University.
- Organizing courses and training programmes for enhancing computer literacy and developing skills.
- Computer Consultancy Service to external organisation agencies.
- Co-coordinating the activities for strengthening computing facility in the university.
- Technical evaluation and feasibility study of IT projects

2. Campus Computing Infrastructure

University Campus has a variety of computing facilities and infrastructure available for students and researchers. The following are some of them:

- High Performance Computing Centre (part of sophisticated Instrumentation and Computation Centre)
- Dedicated 1GBPS connection (National Knowledge Network supplemented by a back-up) between Senate House Campus, University Library and Kariavattom Campus.

- Internet Centre in Campus Library at Kariavattom.
- Dept. level computing infrastructure (totaling about 1500 computers)
- Specialized computing labs in S&T Depts. (Image Processing Lab, Computational Drug Discovery Lab, Embedded System Lab etc.)
- Campus-level web-casting facility.
- Campus-Wi-Fi

The high performance computing facility of University of Kerala is a part of the Campus Computing Facility at Karyavattom Campus and is set up under PURSE project.

Cluster Architecture: A Rocks cluster (Rocks version 6.2 with Cent OS 6.6-64 bit version) which is an implementation of "Beowulf" cluster, running Sun Grid scheduler for job submissions. It has 10 nodes: - a master node with 64GB of RAM, five IBM compute nodes with 8 GB RAM each and four Dell compute nodes with 64GB RAM. Each node is a dual six-core Intel®XeonE5645 series 2.40GHz rack server, thus achieving a theoretical performance of 1 GigaFlops

Front End Node (master**):** Front end nodes are where users login in, submit jobs, compile code, etc. These nodes can also act as a router for other cluster nodes by using network address translation (NAT). Disk: 2 TB; Memory Capacity: 64GB; Ethernet: 2 physical ports, one public, one private.

Compute Nodes: These are the workhorse nodes. Rocks management scheme allows the complete OS to be reinstalled on every compute node in a short amount of time (~10 minutes). These nodes are not seen on the public Internet. Disk Capacity: 300 GB; Memory Capacity: 8 GB.

Ethernet: All compute nodes are connected with Ethernet on the private network. This network is used for administration, monitoring, and basic file sharing. Computational

work is submitted from the login/master node to the compute nodes by users via a batch system. The cluster is accessed remotely *via* SSH. Users authenticate (i.e., login) using an SSH client; after successful authentication a command-line interface is presented. This can be used to submit computational jobs to the *batch system queue.*

MPI Interconnects: The network transport used for MPI messages will depend on the hardware provided with the HPC cluster. This cluster uses gigabit Ethernet networks for MPI traffic. This network is especially designed to provide the fastest message passing systems available at bandwidths of multiple gigabytes per second.

Shared Data Storage: By using share, the management overhead of a large cluster is significantly reduced as there is no need to copy data to every node in the cluster for running jobs. By default, the following shared storage areas are typically configured on the cluster.

Storage mount point on nodes	**File server**	**Purpose**
Home/username	Master node	Shared storage area for users
State/partition 1	Compute node	Temporary storage area
Share/apps	Master node	Shared Application

Chemistry related softwares

- Turbomole 6.4 for quantum chemical application
- NWChem 6.0 ab initio computational chemistry software
- Tinker 6.1 molecular modeling package for molecular mechanics and dynamics
- GROMACS (GROningen MAchine for Chemical Simulations) is a molecular dynamics package primarily designed for simulations of proteins lipids and nucleic acids
- VMD
- Desmond
- High-performance molecular dynamics simulations for bimolecular systems

Bio-informatics applications

- HMMER
- NCBI BLAST
- MpiBLAST
- Biopython
- ClustalW
- MrBayes
- T_Coffee
- Emboss
- Phylip

- Fasta
- Glimmer
- Perl-bioperl

Parallel computing MPI libraries

- OpenMPI
- MPICH
- PVM

Compilers

- C
- C++
- FIRTRAB
- Perl
- Python 2.7 and ipython 0.10 interactive shell for python programming

Statistical Analysis

- IBM SPSS 20
- pspp 0.6.2

Remote Access and Virtual Desktop

- FreeNx for ssh based remote login
- OpenSSH

Statistical computing and Graphics

- R 2.25.2 for Statistical computing and Graphics
- Gnuplot 4.2.6 for 2D and 3D plots
- Python-matplotlib 0.99 2D plotting library

Mathematical and Numerical Computation

- Blas 3.2, Atlas 3.8, GotoBlas2, Openblas linear algebra library
- Scilab 5.4.0 for numerical numerical computation
- Scipy 0.7.2 and numpy 1.4.1 mathematical and scientific computing library

Job Queuing system

- SGE6.2 Sun Grid Engine (Open Grid Scheduler)
- Condor High Throughput Computing environment

Cluster monitoring system

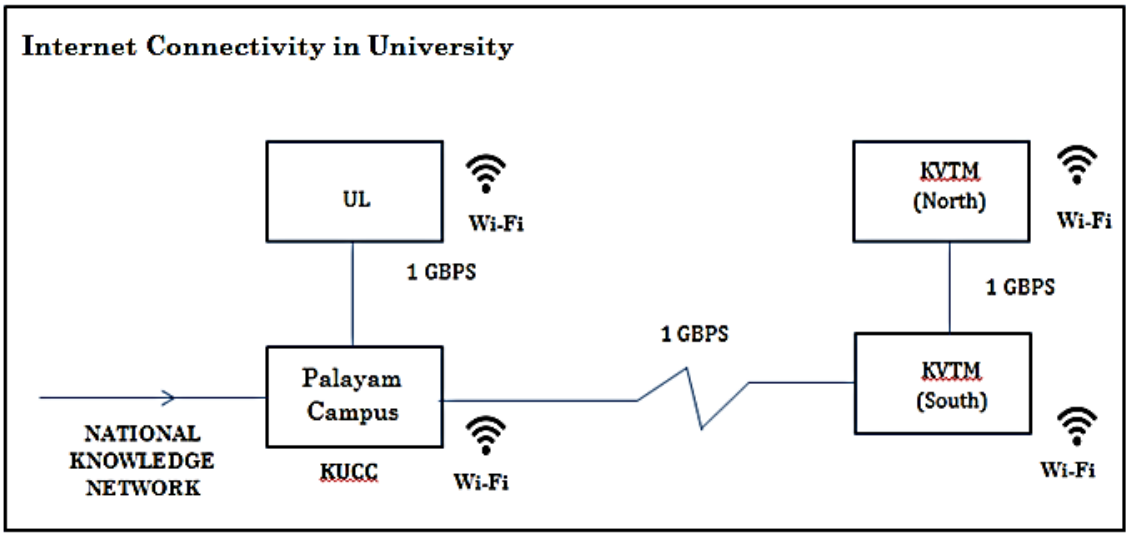
- Ganglia

Web server

- Apache

3. University Email System

University Computer Centre maintains an email server. Students who need an official email id for specific purposes are issued email ids of the style *name.student @keralauniversity.ac.in.* Request may be made to Director, SICC, through head of the Dept.



C3. Sophisticated Instrumentation & Computation Centre (SICC)

Realising that scientific instruments with cutting-edge technology are vital for pursuing research in many areas of modern science and technology, the University of Kerala has setup a centralised research felicity. The Sophisticated Instrumentation and Computation Centre (SICC) at Kariavattom campus is a an initiative with a broad range of state-of-the-art analytical instruments purchased under PURSE Scheme and various other sources. This centre represents one of the largest commitments to research in the history of the University of Kerala to carry forward decades of research into new realms of application and discovery. The vision of SICC is to provide advanced infrastructure and training, with a futuristic approach, to the research community of the University of Kerala to compete on a global level. The researchers in the university are welcome to utilise facilities at the centre.

1. Scanning Probe Microscope (SPM/AFM): The model and make of the instrument is BRUKER Dimension Edge SPM system. AFM imaging is being done in contact mode/ tapping mode/non-contact mode according to the requirement mainly based on nature of the sample. In most cases, topography of different materials in thin film form is analyzed. Cell imaging and biological samples analysis of holograms are also being carried out using the instrument. Other works being done include STM (scanning tunneling microscope) and MFM (magnetic force microscope) measurements

2. <u>iCAP Qc Series iCP-MS with New Wave NWR 213:</u> The iCAP Qc offers uniquely reliable cell mode performance and is configured for high quality analyses in routine, high-throughput laboratories, such as those specialising in environmental analysis, food quality control and geo-chemical exploration. With self-aligning injector, cone and lens assemblies, unparalleled plasma and collision cell stability and improved resistance to heavy sample matrices, the iCAP Q requires less maintenance and delivers accurate results even in challenging and complicated sample conditions. The iCAP Q is the only ICP-MS system to include proprietary QCell technology combining proven He KED (kinetic energy discrimination) interference reduction capabilities with a flatapole low mass cut-off. In comparison with higher-order multipole systems used in collision cells, the flatapoles in the QCell provide a low mass cut off that stops unwanted species from passing to the quadrupole mass filter. This provides complete collision cell reliability, even with new, complicated sample matrices. Elements like As and Hg can be analysed in ICAP Q c without hydride ion generator. Our lab is equipped with Anton parr multiwave 3000 Microwave digester for sample dissolution.

3. <u>X-Ray Diffractometer (XRD)</u>: X-ray Diffraction (XRD) is a high-tech, non-destructive technique for analysing a wide range of materials, including fluids, metals, minerals, polymers, catalysts, plastics, biological materials, pharmaceuticals, thin- film coatings, ceramics, solar cells and semiconductors. XRD is the most wanted tool for industry and research institutes especially for materials investigation, characterisation and quality

control. Example areas of application include qualitative and quantitative phase analysis, crystallography, Molecular structure, crystallite size and strain, structure and relaxation determination, texture and residual stress investigations. The Bruker D8 X-ray diffractometers are designed to easily accommodate all X-ray diffraction applications in material research, powder diffraction and high-resolution diffraction. The intelligent beam path components of the D8 ADVANCE with DAVINCI design provide true plug'n play functionality requiring minimum or even no user intervention. Featuring automatic and tool-free switching of the diffraction geometry without the need for complex adjustments, the D8 ADVANCE with DAVINCI design broadens the analytical capabilities for a wide community of X-ray diffraction users. The package from Bruker also involves Topas (Reitveld Refinement software), Eva (Search Matching software), ICDD database and ICSD database. Hence the present XRD and the software make a perfect tool for structural analysis.

4. Spectral Confocal Microscope (SCM): Confocal microscope has become a power full tool of choice for researchers interested in serious imaging of cell structure and function. These microscopes revolutionised our view of cells and became a major instrument in unravelling the complexities of the morphology and dynamics of cells and tissues. Initially it was used to observe the general spatial distribution of usually one or two fluorescent labelled structure or cell population in living or fixed samples. Now researchers can distinguish between two closely spaced structures within a specific organelle such as visualising RNA polymerase II mediated transcription sites associated with speckles in the nucleus. High resolution confocal microscopy has been used during in situ hybridisation to localise specific gene sequences to specific chromosomes. With the recent technological advances confocal microscopes have opened a new world to biologists interested in the dynamic complexities of the cell and to the researchers in life sciences. With the synergies of multi band spectral detector, acousto-optical beam splitter (AOBS) and super sensitive Leica HyD the microscope provide maximum photon efficiency and gapless spectral detection.This superior sensitivity directly translate into reduced laser power for cell viability and resolution. The AOBS (Acousto-Optical Beam Splitter) is a completely

transparent, active TeO2 crystal, which offers maximum photon efficiency. An acoustic wave coupled into the crystal changes its transmission properties. It switches within microseconds by simply changing the radio frequency of the wave. This makes the AOBS a uniquely flexible, efficient, and fast beam splitter. The AOBS can accommodate up to eight reflection bands.

5. UV-Vis NIR Spectrophotometer: The UV-VIS-NIR spectrum is due to the electronic transitions and vibrational modes of the molecule. This is characteristic of a compound. Qualitative and quantitative estimations of compounds are possible by this non destructive technique. Essential Features: Wave length Range : 175 nm to 3300nm; Resolution: 0.1 nm, Maximum Absorption: 8(abs). Attachments: Diffuse Reflectance Accessory; Absolute Reflectance Accessory ; Sample Transport Accessory ; Temperature Controller

6.Thermo Fisher Scientific iS50 FTIR Spectrophotometer: The infrared spectrum originates from the vibrational motion of the molecule. The vibrational frequencies are a kind of fingerprint of the compounds. This property is used for characterization of organic, inorganic and biological compounds. The band intensities are proportional to the concentration of the compound and hence qualitative estimations are possible. The IR spectroscopy is also carried out by using Fourier transform technique. Essential Specification: Wave number range: 5000 to 700 cm $^{-1}$ and 700 to 50 cm $^{-1}$ (Covering IR & FAR IR); Resolution: 0.1 cm $^{-1}$. Applications:Infrared spectrum is useful in identifying the functional groups like -OH, -CN, -CO, -CH, -NH_2, etc. Also quantitative estimation is possible in certain cases for chemicals, pharmaceuticals, petroleum products, etc. Resins from industries, water and rubber samples can be analyzed. Blood and food materials can also be studied.

UV-Vis NIR Spectrophotometer& FTIR Spectrophotometer

7. Carl Zeiss EVO 18 Secondary Electron Microscope with EDS(SEM): SEM facilitates the observation of very fine details (high resolution) of materials and good focus over a wide range of specimen surface (large depth of field). It also produces clear image of specimen ranging from object visible to the naked eye to a structure spanning few nanometers. Besides its use in studying soils, sedimentary particles, rock materials, synthesized compounds, and biological materials, it also helps to elucidate the architecture and evolution of microfossils. The Energy dispersive X-ray analysis attachment (Thermo SuperDry II) is used to carryout semi quantitative elemental analysis of the samples. A new feature, the Cathedoluminescence detector is installed recently. Essential Features: Resolution: 3nm@30kV HV mode; 10nm @3 kV HV mode, Detectors: Secondary Electron; Semiconductor BSE (Quad type)* Magnification: 5x to 300,000x; Vacuum System: TMP & Rotary to 1.5 x 10 -3 Pa Specimen Stage: Motorised 5-axis, Eucentric Specimen height: 80mm at 10mm W.D. EDX: Peltier cooled X-ray head from Thermo, USA CLD: Cathedoluminescence detector.

8. Bruker Avance III HD 400 MHz One Bay NMR Spectrometer: NMR spectrometer is a specialized equipment used to study the magnetic and chemical environment of certain nuclei like ^{1}H, ^{13}C, ^{19}F, ^{31}P, ^{29}Si etc. The instrument consists of a superconducting magnet which is to be kept cool using liquid helium. The main purpose of the instrument is structure elucidation of organic and biomolecules. When 1D NMR can elucidate small structures, using 2D NMR techniques like COSY, HETCOR etc, larger and more complicated structures can be elucidated. The NMR instrument installed at SICC can detect the chemical environment of all the above said nuclei. It comes with a user friendly software where the researchers can individually process the data. The one-bay model saves room for future up-gradation to solid state NMR application. This instrument is highly useful for our PhD scholars of various departments and research centres for structural elucidation of organic and bioorganic molecules and for detection of the above said nuclei.

9. Thermo Fisher Scientific Sorvall MX50 Centrifuge.

High speed centrifugation for separation of biological/chemical samples.

Applications in Life sciences: Sophisticated Instrumentation & Computation Centre (SICC), initiated by the University houses most modern, interments that can effectively address the challenge to attain quality in life science research. For instance, Confocal microscope available at SICC has the potential to revolutionize the molecular biology where it can be applied to DNA protein interactions, recognition of promoter sequences also in the study of binding of drug molecule at membrane receptors and other targets. Scanning electron microscope is also has wide application in life science research such as micro morphological characterization of plants, pollen studies etc. In the characterization of isolated phytomolecules, FTIR instrument is being immensely helpful. During the in-depth analysis of fruits and other plant materials ICP-MS facility give a detailed elemental profile of the sample. XRD facility is being used by the researcher to gather information on structural details of biomolecules.

Applications in Earth sciences: Trace and REE concentration in rocks, although negligible in amount, can provide important information for unravelling the geodynamic evolution of the crust and mantle. ICPMS is a widely accepted tool in geology for analyzing Trace and REE elements in rocks, minerals and meteorites. TheThermo Fisher iCAP Qc-ICPMS is capable of measuring almost all elements in Periodic Table, with low detection limit and high precision. Scanning Electron Microscopy-Energy Dispersive Spectroscopy is widely used as a fundamental tool to study rocks, minerals, meteorites and fossils. For topographical scanning of geological samples, especially microfossils (4 mm to 1 micron), the scanning based on secondary electrons are very useful. Analysis of sedimentary grain (<1 mm to a micron) surface texture by using SEM is very helpful to understand the imprints preserved on the grains through which to interpret the depositional environment. Back Scattered Electron Imaging technique provides valuable information on compositional distribution of the specimen surface. Energy Dispersive X-ray Spectroscopy (EDS) attached to the SEM can provide semi-quantitative analysis of specimens under investigation.

Applications in Material sciences: Chemistry is one among the many branches of physical sciences, the development of which has greatly influenced life on earth. Over the centuries the subject has grown from its alchemical state to the most modern science. Broadly research in chemistry can be done either in fundamental areas or in an application level. Both the above areas require precise instrumental or computational data collection to ensure solid and meaningful research. The Sophisticated Instrumentation and Computation Centre (SICC) at Kariavattom campus of the University of Kerala hosts most of this facility for research in chemistry. Instruments like UV-Vis-NIR spectrophotometer, FTIR and 400 MHz NMR spectrometer helps in both fundamental and applied research. The high computing facility helps in providing a platform for performing calculations in a parallel environment. The research in material science is an active discipline being followed by the physics and chemistry departments of the campus. Instruments like AFM, SEM, TG-DTA, SCM, XRD, ICPMS etc greatly helps the materials research groups providing required data for speedy research activities. The high performance clusters would help modelling materials and chemical behaviour that would give an idea in advance if the material is of desired use and provide significant competitive advantage.

C4. Department-wise Research Infrastructure

Department of Physics: L.C.R Meter, Photoluminescence spectrophotometer, UV-Visible spectrophotometer, Network Analyzer, Source Meter, Electrometer, Electrical Conductivity Measurement in Vacuum and Desired Atmosphere, High temperature Sample holder for Impedance Measurement, Electrochemical Workstation, Muffle furnaces, Hot air Ovens and Microwave Oven, Z-scan setup

Department of Optoelectronics: Deep Freezer, Nd. YAG Laser with SHG setup, Up gradation of triax nano chromator for Pl setup, Field Emission Scanning Electron Microscope with EDX facility, Micro Raman Spectrometer (with excitation wavelength of 514nm and 785nm available) , UV Visible Spectrophotometer, Spectrofluorometer, Impedance analyzer

Department of Geology: Automatic Absorption Spectrophotometer (GBC Australia-make), UV-Vis Spectrophotometer (Systronics), Olympus Polarizing, Microscope with Camera & imaging software, Anisotrophy of Magnetic susceptibility instrument, Auto titration unit, Resistivity Meter, Infiltrometer, Remote sensing data products, Proprietary and FOSS GIS labs, Atomic Absorption Spectrometer (AAS) for elemental analyses of various media, Fume hood with HF – HNO3 based digestion and solution preparation of rocks, minerals and refractories – well equipped chemical lab to analyze rock and water samples – material characterisation.

Department of Computer Science: PG lab with 33 Nos. of Desktop PC's including Intel Core 2 Due, IBM, server etc, Digital Image Computing lab I – with 18 Nos. of High-end systems including Intel Core : 7 systems, Digital Image Computing Lab II with 18 Nos. of systems including Intel Core i3, Intel Core 2 Due systems, Embedded Systems lab with 10 Nos. of Intel Dual Core IBM systems, Oracle Database lab with 30 Nos Dell Laptops and HP Server as Oracle Server, Medical Image Processing (MIP) Research lab for Research scholars with 12 Nos. of High and Systems and workstation including Intel Core i7, Intel Xeon Workstation, HP Supercomputer with NVIDIA Tesla GPU

Department of Demography: Computer Lab, Census Work station

Department of Biochemistry: Fluorescent Microscope, Thermocycler (Semi quantitative), Real time thermocycler, Lyophilizer, Cold Centrifuge, ELISA plate reader, Gel DOC, HPLC , Sonicator, UV-Visible Spectrophotometer, FTIR, Animal House facility, Bioinformatics lab, Electrophoresis, Tissue culture facility, Ultracentrifuge, Refrigerated micro centrifuge, Biophotometer, Deep freezer -80 and -20, Cold room, Western Blotting apparatus, Homogenizer, Microbial culture facility

Department of Chemistry: Electrochemical Impedance Spectrometer SP 200, Rotary Evaporator Heicdolph, CARY 630 FTIR with PC, Printer, UPS, HPC with 4 servers of Gaussian 09 software, JASCO HPLC with PC, HORIBA DLS with PC, Printer UPS, Vacuum Oven, Electro chemical work station, UV-VIS spectrophotometer, Spectrofluorometer, AAS, Muffle furnace, Autoclave, Sunning electrochemical, Hydrogen GC microscope

Department of Archaeology: GIS Lab, Archaeozoology and Archaeoicthyology Lab, Total station – 1, Munsell Rock Chart – 1, GPS 12, Weighing scale – 5, Vernier caliper – 10, Digital camera – 3, Munsell soil colour chart – 1, A3 Negative flat-bed scanner – 1

Department of Environmental Sciences: High Performance Liquid chromatography (Shimadzu), Water Testing Facility, FRITSCH PULVERISETTE – 7, Denaturing Gradient Gel Electrophoresis Unit (DGGE), CBS Scientific, UV-Vis Spectrophotometer, Stereo zoom microscope, Random Analyser (Durridve)

Department of Aquatic Biology & Fisheries: HPLC, PCR, Ultra centrifuge, Lyophiliser, Compound Microscope with imaging facility UV-VIS, Double beam spectrophotometer), Gel Documentation system, Deep Freezer C -20 and -80), Stereo Zoom Microscope

Department of Botany: High Speed Cooling Centrifuge, UV-Vis, spectrophotometer, Stereo- Zoom Microscope, Image Analyser, Leica Image Analyser Cryotome, Phase contract microscope, Protein purification System & Fraction collector, PCR HPLC, GC, Real time PCR, Gel Documentation System, Deep Freezer–80, Elisa Reader, Biophotometer, Sonicator, Deep Freezer–40–2016, Nitrogen Analyser, Rotary evaporator, Walk in Cold Room, Herbarium, Herbal Garden, Green House, Seed bank

Biotechnology: Animal Cell Culture Facility- Carbon Dioxide Incubator, Inverted Microscope, Inverted Fluorescent Microscope Fermenter, Molecular Biology/ Biochemistry- Microbiology: Refrigerated centrifuges, Refrigerated Micro centrifuge, Protein Gel Electrophoresis, Iso-electric Focusing (IEF),2D Gel Electrophoresis, DNA Electrophoresis, Gel documentation system, Liquid Chromatography with fraction collector, Fast Performance Liquid Chromatography, Laboratory Fermenter/Bioreactor, ELISA Reader, UV-Vis Spectrophotometer, Speed Vac Concentrator, Cryocan for Liquid Nitrogen, HPLC for purification of organic compounds, PCR and RT PCR, Facility for large scale cultivation of animal cell cultures.

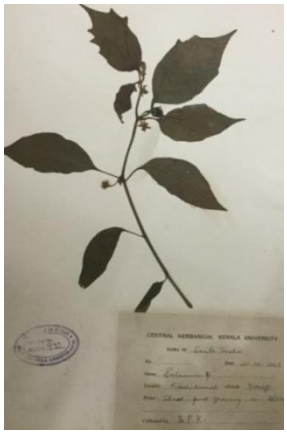
Dept. of Computational Biology & Bioinformatics: Informatics Lab, Drug discovery Lab, Basic Molecular Biology lab, Bio-electronics Lab, Drug Docking Station

University College of Engineering, Karyavattom: Labs under EC Dept.: Electronics circuits lab, Digital electronics lab, Communication engineering lab, Microwave & optical communication lab, Digital signal processing lab**. Labs under CSE Dept.:** Internet lab**,** System software lab**. Labs under IT Dept:** Multimedia lab**,** Network lab

C5. Special Facilities in Dept. of Botany

Seed Bank: Department of Botany, University of Kerala has recently established a seed bank facility for the seed conservation of indigenous crops, vegetables, underutilized vegetables, fruits, and medicinal plants, with support of Kerala State Biodiversity Board, Govt. of Kerala. The seed bank was formally inaugurated by Prof. Oommen V. Oommen, Chairman, Kerala State Biodiversity Board on April 8, 2016. As a part of seed banking program, a massive effort to procure seeds of underutilized vegetables, fruits and medicinal plants are under taken. Procuring seeds from traditional farmers in the state, home gardens are initiated especially for indigenous crops and underutilized crops, besides, on-going seed collections from the wild. The collected seeds are duly dried and processed in the laboratory. They are tested for seed viability, germination and level of moisture (< 7%), prior to storing at 4°C in a walk-in-cold room or at -20°C in a deep freezer. Low temperature storage practice significantly extends seed viability especially in case of orthodox types of seeds. Seed Bank is expected to serve as seed source for researchers and small / traditional growers. University has signed a tripartite MoU with Jawaharlal Nehru Botanic Garden & Research Institute and Kerala Forest Research Institute on 'Seed Bank maintenance and enrichment'. It is hoped that the facility will develop into a full-fledged seed bank that will serve as repository of seeds of rare, endangered, threatened (RET) plants, wild relatives of crop plants, and underutilized plants in the state, and thus boost conservation activities in accordance to Global Strategy for Plant Conservation (GSPC) of Botanic Garden Conservation International.

Kerala University Botany Herbarium (KUBH) was established in the year 1989. (Registered in Index Herbarium, New York: with an Acronym – KUBH). Just like in a library, the dried plant specimens are arranged in the herbarium in systematic order, by plant family, according to Bentham and Hooker, 1876 & Smith *et al*., 2006, systems of classification. The collections of KUBH includes Angiosperms (5291), Gymnosperms (21) Pteridophytes (2000) Bryophytes (10) Lichen, Fungi and Algae (40) and type specimens (50)] totalling over 7362. More than 3000 specimens are yet to be identified and several new specimens are arriving periodically in the herbaria.



KUBH supports (i)the correct identification of plant specimens (ii) form the basis for research and preparation of Floras (iii) provide the comparative material essential for studies in taxonomy, systematics, ecology, anatomy, morphology, conservation biology, biodiversity, ethnobotany, paleobotany (iv) for teaching.(v) for being used by the public and (iv) for the preservation of voucher specimens.

Rare collections of KUBH: (i) Rama Rao, Vencoba Rao/ Bourdillon and Gamble identified sheets. (ii) Rare species of wild orchids and ferns from Western Ghats collected by the founder Prof. A. Abraham. (iii) Unique and best collections of Pteridophytes in South India. (iv) *Ophioglossum reticulatum* (Highest chromosome number reported in (n=630) by Prof. (Dr.) C. A. Ninan, & Prof. (Dr.) A. Abraham, Former Heads of the Department). (v)Wild species of *Oryza.(vi)*Rich collection of members of the families Commelinaceae, Poaceae, Cyperaceae.(vii) Endemic plants of Southern Western Ghats and collection of RET plants

Services rendered by KUBH: (i) Identification of plants for researchers and students of the Department of Botany as well as for the sister departments and other institutions. (ii) Deposition of the voucher specimens and issuing voucher number and certificate of identification. (iii) Giving Training in the preparation and maintenance of herbarium for the school students, researchers and to the general public. (iv) Taking projects to identify the plants inside and outside the premises of various organizations, institutions and Government bodies.

C6. University Museums, Gardens etc.

1. Rock Museum, Dept. of Geology

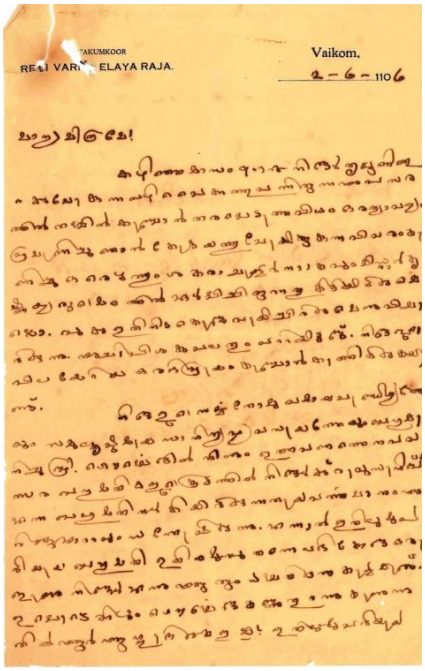
2. Archaeological Museum, Dept. of Archaeology

3. Kerala University Herbarium, Dept. of Botany

4. Thulaseevanam Herbal Garden

5. Marine Museum, Dept. of Aquatic Biology & Fisheries

6. Scriptorium, International Centre for Kerala Studies



7.Trivandrum Observatory: The Astronomical Observatory in Thiruvananthapuram, under University of Kerala situated 60m above sea level, is located on a hill near the Napier Museum and the Kanakakunnu Palace. It is one of the oldest observatories in India and built by King Swathi Thirunal, in 1836. The telescopes of 1830s are still in use.

Observatory: A sketch form 19th Centuary

8. Oriental Research Institute and Manuscript Library (ORIMSL): The oriental research institute and Manuscript library of University of Kerala in its Karyavattom campus is a treasure house of 75,000 manuscripts documenting traditional knowledge. It has a history of about a century and a half and is considered to be among largest manuscripts Libraries of India. Manuscripts are in different subjects like Jyotisa, Ganita, Silpa, Vedanta, Vyakarana, Mimamsa, Tantra, Natya, Itihasa, Purana etc. Majority of the works are in Sanskrit Language and all other Indian languages and a few from Burmese and Indonesian. Rare exhibits include Chithra-ramayan, a 400 year old picture-book and ivory plates and gold-embroidered paintings.

Part D : Articles on Research & Innovation

- **Wikipedia on 'Research'**
- **Who is afraid of Research?**
- **Academic Language: Principles and Techniques**
- **Evolving Patterns of Doctoral Degree Award**
- **On "I don't know"**
- **Tips on making Powerful Presentations**
- **Introductory Data Analysis using R**
- **സാഹിത്യ ഗവേഷണം - ഭൂമിക**
- **Animal Experimentation – Ethical & Legal Issues**
- **Do- it-yourself: Guide for Fair Tests**

D1. Wikipedia on 'Research'

Research comprises "creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications." It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. A research project may also be an expansion on past work in the field. Research projects can be used to develop further knowledge on a topic, or in the example of a school research project, they can be used to further a student's research prowess to prepare them for future jobs or reports. To test the validity of instruments, procedures, or experiments, research may replicate elements of prior projects or the project as a whole. The primary purposes of basic research (as opposed to applied research) are documentation, discovery, interpretation, or the research and development (R&D) of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences.

There are several forms of research: scientific, humanities, artistic, economic, social, business, marketing, practitioner research, life, technological, etc.

Etymology

The word *research* is derived from the Middle French "*recherche*", which means "to go about seeking", the term itself being derived from the Old French term "*recerchier*" a compound word from "re-" + "cerchier", or "sercher", meaning 'search'. The earliest recorded use of the term was in 1577.

Definitions

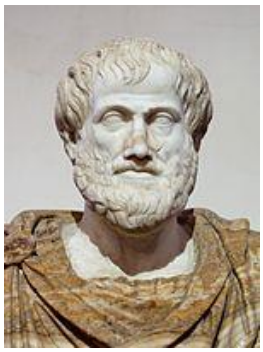
Research has been defined in a number of different ways.

A broad definition of research is given by Godwin Colibao: "In the broadest sense of the word, the definition of research includes any gathering of data, information, and facts for the advancement of knowledge."

Another definition of research is given by John W. Creswell, who states that "[r]esearch is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: pose a question, collect data to answer the question, and present an answer to the question.

The Merriam-Webster Online Dictionary defines research in more detail as "a studious inquiry or examination; especially investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws".

Forms of research



Aristotle, (384–322 BC), one of the early figures in the development of the scientific method

Original research is research that is not exclusively based on a summary, review or synthesis of earlier publications on the subject of research. This material is of a primary source character. The purpose of the original research is to produce new knowledge, rather than to present the existing knowledge in a new form (*e.g.*, summarized or classified).

Original research can take a number of forms, depending on the discipline it pertains to. In experimental work, it typically involves direct or indirect observation of the researched subject(s), e.g., in the laboratory or in the field, documents the methodology, results, and conclusions of an experiment or set of experiments, or offers a novel interpretation of previous results. In analytical work, there are typically some new (for example) mathematical results produced, or a new way of approaching an existing problem. In some subjects which do not typically carry out experimentation or analysis of this kind, the originality is in the particular way existing understanding is changed or re-interpreted based on the outcome of the work of the researcher.

The degree of originality of the research is among major criteria for articles to be published in academic journals and usually established by means of peer review. Graduate students are commonly required to perform original research as part of a dissertation.

Scientific research is a systematic way of gathering data and harnessing curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organizations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines. Scientific research is a widely used criterion for judging the standing of an academic institution, but some argue that such is an inaccurate assessment of the institution, because the quality of research does not tell about the quality of teaching (these do not necessarily correlate).

Research in the humanities involves different methods such as for example hermeneutics and semiotics. Humanities scholars usually do not search for the ultimate correct answer to a question, but instead, explore the issues and details that surround it. Context is always important, and context can be social, historical, political, cultural, or ethnic. An example of research in the humanities is historical research, which is embodied in historical method. Historians use primary sources and other evidence to systematically investigate a topic, and then to write histories in the form of accounts of

the past. Other studies aim to merely examine the occurrence of behaviours in societies and communities, without particularly looking for reasons or motivations to explain these. These studies may be qualitative or quantitative, and can use a variety of approaches, such as queer theory or feminist theory.

Artistic research, also seen as 'practice-based research', can take form when creative works are considered both the research and the object of research itself. It is the debatable body of thought which offers an alternative to purely scientific methods in research in its search for knowledge and truth.

Scientific research

Generally, research is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher, the following steps are usually part of most formal research, both basic and applied:

Primary scientific research being carried out at the MicroscopyLaboratory of the Idaho National Laboratory.

1. Observations and formation of the topic: Consists of the subject area of one's interest and following that subject area to conduct subject related research. The subject area should not be randomly chosen since it requires reading a vast amount of literature on the topic to determine the gap in the literature the researcher intends to narrow. A keen interest in the chosen subject area is advisable. The research will have to be justified by linking its importance to already existing knowledge about the topic.
2. Hypothesis: A testable prediction which designates the relationship between two or more variables.
3. Conceptual definition: Description of a concept by relating it to other concepts.
4. Operational definition: Details in regards to defining the variables and how they will be measured/assessed in the study.

Scientific research equipment at MIT.

5. Gathering of data: Consists of identifying a population and selecting samples, gathering information from or about these samples by using specific research instruments. The instruments used for data collection must be valid and reliable.
6. Analysis of data: Involves breaking down the individual pieces of data to draw conclusions about it.
7. Data Interpretation: This can be represented through tables, figures, and pictures, and then described in words.

8. Test, revising of hypothesis
9. Conclusion, reiteration if necessary

A common misconception is that a hypothesis will be proven (see, rather, null hypothesis). Generally, a hypothesis is used to make predictions that can be tested by observing the outcome of an experiment. If the outcome is inconsistent with the hypothesis, then the hypothesis is rejected (see falsifiability). However, if the outcome is consistent with the hypothesis, the experiment is said to support the hypothesis. This careful language is used because researchers recognize that alternative hypotheses may also be consistent with the observations. In this sense, a hypothesis can never be proven, but rather only supported by surviving rounds of scientific testing and, eventually, becoming widely thought of as true.

A useful hypothesis allows prediction and within the accuracy of observation of the time, the prediction will be verified. As the accuracy of observation improves with time, the hypothesis may no longer provide an accurate prediction. In this case, a new hypothesis will arise to challenge the old, and to the extent that the new hypothesis makes more accurate predictions than the old, the new will supplant it. Researchers can also use a null hypothesis, which states no relationship or difference between the independent or dependent variables.

Historical research

The historical method comprises the techniques and guidelines by which historians use historical sources and other evidence to research and then to write history. There are various history guidelines that are commonly used by historians in their work, under the headings of external criticism, internal criticism, and synthesis. This includes lower criticism and sensual criticism. Though items may vary depending on the subject matter and researcher, the following concepts are part of most formal historical research.

- Identification of origin date
- Evidence of localization
- Recognition of authorship
- Analysis of data
- Identification of integrity
- Attribution of credibility

German maritime research vessel*Sonne*

Artistic research

The controversial trend of artistic teaching becoming more academics-oriented is leading to artistic research being accepted as the primary mode of enquiry in art as in the case of other disciplines. One of the characteristics of artistic research is that it must accept subjectivity as opposed to the classical scientific methods. As such, it is similar to

the social sciences in using qualitative research and inter-subjectivity as tools to apply measurement and critical analysis.

Artistic research has been defined by the University of Dance and Circus (Dans och Cirkushögskolan, DOCH), Stockholm in the following manner - "Artistic research is to investigate and test with the purpose of gaining knowledge within and for our artistic disciplines. It is based on artistic practices, methods, and criticality. Through presented documentation, the insights gained shall be placed in a context." Artistic research aims to enhance knowledge and understanding with presentation of the arts. For a survey of the central problematics of today's Artistic Research, see Giaco Schiesser.

German historian Leopold von Ranke (1795–1886), considered to be one of the founders of modern

According to artist Hakan Topal, in artistic research, "perhaps more so than other disciplines, intuition is utilized as a method to identify a wide range of new and unexpected productive modalities". Most writers, whether of fiction or non-fiction books, also have to do research to support their creative work. This may be factual, historical, or background research. Background research could include, for example, geographical or procedural research.

The Society for Artistic Research (SAR) publishes the triannual *Journal for Artistic Research* (JAR), an international, online, open access, and peer-reviewed journal for the identification, publication, and dissemination of artistic research and its methodologies, from all arts disciplines and it runs the *Research Catalogue* (RC), a searchable, documentary database of artistic research, to which anyone can contribute.

Patricia Leavy addresses eight arts-based research (ABR) genres: narrative inquiry, fiction-based research, poetry, music, dance, theatre, film, and visual art.

In 2016 ELIA (European League of the Institutes of the Arts) launched *The Florence Principles' on the Doctorate in the Arts*. The Florence Principles relating to the Salzburg Principles and the Salzburg Recommendations of EUA (European University Association) name seven points of attention to specify the Doctorate / PhD in the Arts compared to a scientific doctorate / PhD The Florence Principles have been endorsed and are supported also by AEC, CILECT, CUMULUS and SAR.

Steps in conducting research

Research is often conducted using the hourglass model structure of research. The hourglass model starts with a broad spectrum for research, focusing in on the required information through the method of the project (like the neck of the hourglass), then expands the research in the form of discussion and results. The major steps in conducting research are:

- Identification of research problem
- Literature review
- Specifying the purpose of research
- Determining specific research questions
- Specification of a conceptual framework, usually a set of hypotheses[32]
- Choice of a methodology (for data collection)
- Data collection
- Verifying data
- Analyzing and interpreting the data
- Reporting and evaluating research
- Communicating the research findings and, possibly, recommendations

The steps generally represent the overall process; however, they should be viewed as an ever-changing iterative process rather than a fixed set of steps. Most research begins with a general statement of the problem, or rather, the purpose for engaging in the study. The literature review identifies flaws or holes in previous research which provides justification for the study. Often, a literature review is conducted in a given subject area before a research question is identified. A gap in the current literature, as identified by a researcher, then engenders a research question. The research question may be parallel to the hypothesis. The hypothesis is the supposition to be tested. The researcher(s) collects data to test the hypothesis. The researcher(s) then analyzes and interprets the data via a variety of statistical methods, engaging in what is known as empirical research. The results of the data analysis in rejecting or failing to reject the null hypothesis are then reported and evaluated. At the end, the researcher may discuss avenues for further research. However, some researchers advocate for the reverse approach: starting with articulating findings and discussion of them, moving "up" to identification of a research problem that emerges in the findings and literature review. The reverse approach is justified by the transactional nature of the research endeavor where research inquiry, research questions, research method, relevant research literature, and so on are not fully known until the findings have fully emerged and been interpreted.

Rudolph Rummel says, "... no researcher should accept any one or two tests as definitive. It is only when a range of tests are consistent over many kinds of data, researchers, and methods can one have confidence in the results."

Plato in Meno talks about an inherent difficulty, if not a paradox, of doing research that can be paraphrased in the following way, "If you know what you're searching for, why do you search for it?! [i.e., you have already found it] If you don't know what you're searching for, what are you searching for?!"

Research methods

The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue. This process takes three main forms (although, as previously discussed, the boundaries between them may be obscure):

- Exploratory research, which helps to identify and define a problem or question.
- Constructive research, which tests theories and proposes solutions to a problem or question.
- Empirical research, which tests the feasibility of a solution using empirical evidence.

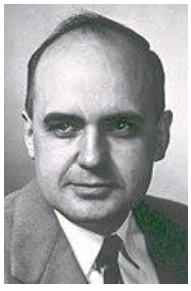
The research room at the New York Public Library, an example of secondary research in progress.

There are two major types of empirical research design: qualitative research and quantitative research. Researchers choose qualitative or quantitative methods according to the nature of the research topic they want to investigate and the research questions they aim to answer:

Qualitative research

This involves understanding human behaviour and the reasons that govern such behaviour, by asking a broad question, collecting data in the form of words, images, video etc that is analyzed, and searching for themes. This type of research aims to investigate a question without attempting to quantifiably measure variables or look to potential relationships between variables. It is viewed as more restrictive in testing hypotheses because it can be expensive and time-consuming and typically limited to a single set of research subjects. Qualitative research is often used as a method of exploratory research as a basis for later quantitative research hypotheses. Qualitative research is linked with the philosophical and theoretical stance of social constructionism. Social media posts are used for qualitative research.

Quantitative research



Maurice Hillemanis credited with saving more lives than any other scientist of the 20th century.

This involves systematic empirical investigation of quantitative properties and phenomena and their relationships, by asking a narrow question and collecting numerical data to analyze it utilizing statistical methods. The quantitative research designs are experimental, correlational, and survey (or descriptive). Statistics derived from quantitative research can be used to establish the existence of associative or causal relationships between variables. Quantitative research is linked with the philosophical and theoretical stance of positivism.

The quantitative data collection methods rely on random

sampling and structured data collection instruments that fit diverse experiences into predetermined response categories.[These methods produce results that are easy to summarize, compare, and generalize.[Quantitative research is concerned with testing hypotheses derived from theory or being able to estimate the size of a phenomenon of interest.

If the research question is about people, participants may be randomly assigned to different treatments (this is the only way that a quantitative study can be considered a true experiment). If this is not feasible, the researcher may collect data on participant and situational characteristics to statistically control for their influence on the dependent, or outcome, variable. If the intent is to generalize from the research participants to a larger population, the researcher will employ probability sampling to select participants.

In either qualitative or quantitative research, the researcher(s) may collect primary or secondary data. Primary data is data collected specifically for the research, such as through interviews or questionnaires. Secondary data is data that already exists, such as census data, which can be re-used for the research. It is good ethical research practice to use secondary data wherever possible.

Mixed-method research, i.e. research that includes qualitative and quantitative elements, using both primary and secondary data, is becoming more common. This method has benefits that using one method alone cannot offer. For example, a researcher may choose to conduct a qualitative study and follow it up with a quantitative study to gain additional insights.

Big data has brought big impacts on research methods so that now many researchers do not put much effort into data collection; furthermore, methods to analyze easily available huge amounts of data have also been developed.

Non-empirical research

Non-empirical (theoretical) research is an approach that involves the development of theory as opposed to using observation and experimentation. As such, non-empirical research seeks solutions to problems using existing knowledge as its source. This, however, does not mean that new ideas and innovations cannot be found within the pool of existing and established knowledge. Non-empirical research is not an absolute alternative to empirical research because they may be used together to strengthen a research approach. Neither one is less effective than the other since they have their particular purpose in science. Typically empirical research produces observations that need to be explained; then theoretical research tries to explain them, and in so doing generates empirically testable hypotheses; these hypotheses are then tested empirically, giving more observations that may need further explanation; and so on. See Scientific method.

A simple example of a non-empirical task is the prototyping of a new drug using a differentiated application of existing knowledge; another is the development of a

business process in the form of a flow chart and texts where all the ingredients are from established knowledge. Much of cosmological research is theoretical in nature. Mathematics research does not rely on externally available data; rather, it seeks to prove theorems about mathematical objects.

Research ethics

Research ethics involves the application of fundamental ethical principles to a variety of topics involving research, including scientific research. These include the design and implementaion of research involving human experimentation, animal experimentation various aspects of academic scandal, including scientific misconduct (such as fraud, fabrication of data and plagiarism), whistleblowing; regulation of research, etc. Research ethics is most developed as a concept in medical research. The key agreement here is the 1964 Declaration of Helsinki. The Nuremberg Code is a former agreement, but with many still important notes. Research in the social sciences presents a different set of issues than those in medical research and can involve issues of researcher and participant safety, empowerment and access to justice. When research involves human subjects, obtaining informed consent from them is essential.

Problems in research

Methods of research

In many disciplines, Western methods of conducting research are predominant. Researchers are overwhelmingly taught Western methods of data collection and study. The increasing participation of indigenous peoples as researchers has brought increased attention to the lacuna in culturally-sensitive methods of data collection. Non-Western methods of data collection may not be the most accurate or relevant for research on non-Western societies. For example, *"Hua Oranga"* was created as a criterion for psychological evaluation in Māori populations, and is based on dimensions of mental health important to the Māori people – "taha wairua (the spiritual dimension), taha hinengaro (the mental dimension), taha tinana (the physical dimension), and taha whanau (the family dimension)".

Linguicism

Periphery scholars face the challenges of exclusion and linguicism in research and academic publication. As the great majority of mainstream academic journals are written in English, multilingual periphery scholars often must translate their work to be accepted to elite Western-dominated journals. Multilingual scholars' influences from their native communicative styles can be assumed to be incompetence instead of difference.

Publication Peer Review

Peer Review is a form of self-regulation by qualified members of a profession within the relevant field. Peer review methods are employed to maintain standards of quality, improve performance, and provide credibility. In academia, scholarly peer review is often used to determine an academic paper's suitability for publication. Usually, the peer review process involves experts in the same field who are consulted by editors to give a review of the scholarly works produced by a colleague of theirs from an unbiased and impartial point of view, and this is usually done free of charge. The tradition of peer reviews being done for free has however brought many pitfalls which are also indicative of why most peer reviewers decline many invitations to review. It was observed that publications from periphery countries rarely rise to the same elite status as those of North America and Europe, because limitations on the availability of resources including high-quality paper and sophisticated image-rendering software and printing tools render these publications less able to satisfy standards currently carrying formal or informal authority in the publishing industry. These limitations in turn result in the under-representation of scholars from periphery nations among the set of publications holding prestige status relative to the quantity and quality of those scholars' research efforts, and this under-representation in turn results in disproportionately reduced acceptance of the results of their efforts as contributions to the body of knowledge available worldwide.

Influence of the open-access movement

The open access movement assumes that all information generally deemed useful should be free and belongs to a "public domain", that of "humanity". This idea gained prevalence as a result of Western colonial history and ignores alternative conceptions of knowledge circulation. For instance, most indigenous communities consider that access to certain information proper to the group should be determined by relationships.

There is alleged to be a double standard in the Western knowledge system. On the one hand, "digital right management" used to restrict access to personal information on social networking platforms is celebrated as a protection of privacy, while simultaneously when similar functions are utilised by cultural groups (i.e. indigenous communities) this is denounced as "access control" and reprehended as censorship.

Future perspectives

Even though Western dominance seems to be prominent in research, some scholars, such as Simon Marginson, argue for "the need [for] a plural university world". Marginson argues that the East Asian Confucian model could take over the Western model.

This could be due to changes in funding for research both in the East and the West. Focussed on emphasizing educational achievement, East Asian cultures, mainly in China and South Korea, have encouraged the increase of funding for research expansion. In contrast, in the Western academic world, notably in the United Kingdom as well as in

some state governments in the United States, funding cuts for university research have occurred, which some say may lead to the future decline of Western dominance in research.

Publishing

Academic publishing is a system that is necessary for academic scholars to peer review the work and make it available for a wider audience. The system varies widely by field and is also always changing, if often slowly. Most academic work is published in journal article or book form. There is also a large body of research that exists in either a thesis or dissertation form. These forms of research can be found in databases explicitly for theses and dissertations. In publishing, STM publishing is an abbreviation for academic publications in science, technology, and medicine.


NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

THURSDAY, NOVEMBER 4, 1869

NATURE: APHORISMS BY GOETHE

Cover of the first issue of *Nature*, 4 November 1869.

Most established academic fields have their own scientific journals and other outlets for publication, though many academic journals are somewhat interdisciplinary, and publish work from several distinct fields or subfields. The kinds of publications that are accepted as contributions of knowledge or research vary greatly between fields, from the print to the electronic format. A study suggests that researchers should not give great consideration to findings that are not replicated frequently. It has also been suggested that all published studies should be subjected to some measure for assessing the validity or reliability of its procedures to prevent the publication of unproven findings. Business models are different in the electronic environment. Since about the early 1990s, licensing of electronic resources, particularly journals, has been very common. Presently, a major trend, particularly with respect to scholarly journals, is open access. There are two main forms of open access: open access publishing, in which the articles or the whole journal is freely available from the time of publication, and self-archiving, where the author makes a copy of their own work freely available on the web.

Timeline of the history of scientific method

This **timeline of the history of scientific method** shows an overview of the cultural inventions that have contributed to the development of the scientific method.

BC

- c. 1600 BC — The Edwin Smith Papyrus, an Egyptian surgical textbook, which applies: examination, diagnosis, treatment and prognosis, to injuries, paralleling rudimentary empirical methodology.
- 624 - 548 Thales raised the study of nature from the realm of the mythical to the level of empirical study.
- 610 - 547 Anaximander extends the idea of "law" to the physical world and uses maps and models.
- c. 400 BC — In China, Mozi and the School of Names advocate using one's senses to observe the world, and develop the "three-prong method" for testing the truth or falsehood of statements.
- c. 400 BC — Democritus advocates inductive reasoning through a process of examining the causes of sensory perceptions and drawing conclusions about the outside world.
- c. 400 BC — Plato first provides a detailed definitions for idea, matter, form and appearance as abstract concepts.
- c. 320 BC — First comprehensive documents categorising and subdividing knowledge, dividing knowledge into different areas by Aristotle,(physics, poetry, zoology, logic, rhetoric, politics, and biology). Aristotle's Posterior Analytics defends the ideal of science as necessary demonstration from axioms known with certainty. Aristotle believes that the world is real and that we can learn the truth by experience. Latin: experimentum
- c. 341-270 Epicurus scientific method with multiple variables.
- c. 300 BC — Euclid's Elements expound geometry as a system of theorems following logically from axioms known with certainty.
- c. 240 BC — Eratosthenes best known for being the first person to calculate the circumference of the Earth, which he did by applying a measuring system using stadia, which was a standard unit of measure during that time period. His calculation was remarkably accurate.
- c. 200 BC — First Cataloged library (at Alexandria)
- c. 150 BC — The Book of Daniel describes a clinical trial proposed by Daniel in which he and his three companions eat vegetables and water for 10 days rather than the royal food and wine.

1st through 12th centuries

- c 90-c168 Claudius Ptolemy

- 1021 — Alhazen introduces the experimental method and combines observations, experiments and rational arguments in his *Book of Optics*.
- c. 1025 — Abū Rayhān al-Bīrūnī, develops experimental methods for mineralogy and mechanics, and conducts elaborate experiments related to astronomical phenomena.
- 1027 — In *The Book of Healing*, Avicenna criticizes the Aristotelian method of induction, arguing that "it does not lead to the absolute, universal, and certain premises that it purports to provide", and in its place, develops examination and experimentation as a means for scientific inquiry.

13th through 17th centuries

- 1220–1235 — Robert Grosseteste, an English scholastic philosopher, theologian and the bishop of Lincoln, published his Aristotelian commentaries, which laid out the framework for the proper methods of science.
- 1265 — Roger Bacon, an English monk, inspired by the writings of Grosseteste, described a scientific method, which he based on a repeating cycle of observation, hypothesis, experimentation, and the need for independent verification. He recorded the manner in which he conducted his experiments in precise detail so that others could reproduce and independently test his results.
- 1327 — Ockham's razor clearly formulated (by William of Ockham) which states that among competing hypotheses, the one with the fewest assumptions should be selected.
- 1403 — Yongle Encyclopedia, the first collaborative encyclopedia
- 1581 — Francisco Sanches uses classical skeptical arguments to show that science, in the Aristotelian sense of giving necessary reasons or causes for the behavior of nature, cannot be attained.
- 1581 — Tycho Brahe builds large scale research facility, Stjerneborg dedicated to obtaining high precision measurements of the planets.
- 1595 — Microscope invented in the Netherlands
- 1600 — First dedicated laboratory
- 1608 — Telescope invented in the Netherlands
- 1620 — *Novum Organum* published, (Francis Bacon)
- 1637 — First Scientific method (René Descartes)

- 1638 — Galileo's Two New Sciences published, containing two thought experiments, namely Galileo's Leaning Tower of Pisa experiment and Galileo's ship, which are intended to disprove existing physical theories by showing that they have contradictory consequences.
- 1650 — Society of experts (the Royal Society)
- 1650 — Experimental evidence established as the arbiter of truth (the Royal Society)
- 1665 — Repeatability established (Robert Boyle)
- 1665 — Scholarly journals established
- 1675 — Peer review begun
- 1687 — Hypothesis/prediction (Isaac Newton)

18th and 19th centuries

- 1739 — David Hume's *Treatise of Human Nature* argues that the problem of induction is unsolvable.
- 1753 — First description of a controlled experiment using identical populations with only one variable: James Lind's research into Scurvy among sailors.[8]
- 1763 — Reverend Thomas Bayes published *An Essay towards solving a Problem in the Doctrine of Chances* laying the basis for Bayesian inference, a method of inference used to update the probability estimate for a hypothesis as additional evidence is acquired.
- 1812 — The formulation by Hans Christian Ørsted of the Latin-German mixed term *Gedankenexperiment* (lit. experiment conducted in the thoughts, or thought experiment). Although the method had been in use by philosophers since antiquity.
- 1815 — an optimal design for polynomial regression is published by Joseph Diaz Gergonne.
- 1833 - William Whewell invents the term scientist. They had previously been known as *natural philosophers* or *men of science*.
- 1840 - William Whewell in *Philosophy of the Inductive Sciences* coins the term "consilience" the principle that evidence from independent, unrelated sources can "converge" to strong conclusions.
- 1877–1878 — Charles Sanders Peirce publishes "Illustrations of the Logic of Science", popularizing his trichotomy of Abduction, Deduction and Induction. Peirce explains randomization as a basis for statistical inference.
- 1885 — C. S. Peirce with Joseph Jastrow first describes blinded, randomized experiments, which become established in psychology.[9]

- 1897 — Thomas Chrowder Chamberlin proposes the use of multiple hypotheses to assist in the design of experiments.

20th and 21st centuries

- 1926- Randomized design popularized and analyzed by Ronald Fisher (following Peirce)
- 1934 - Falsifiability as a criterion for evaluating new hypotheses is popularized by Karl Popper's *The Logic of Scientific Discovery* (following Peirce)
- 1937 - Controlled placebo trial
- 1946 - First computer simulation
- 1950 - Double blind experiment
- 1962 - Meta study of scientific method (Thomas Kuhn's *The Structure of Scientific Revolutions*)
- 1964 -Strong inference proposed by John R. Platt
- 2009 -Adam - First working prototype of a "robot scientist" able to perform independent experiments to test hypotheses and interpret findings without human guidance.

D2. WHO IS AFRAID OF RESEARCH?

- A Confetti of thoughts on Research[2]

OPENING REMARKS

As the tagline of this article indicates, this is a disorganized article which strings together some thoughts related to research, not always in logical order or in a continuous flow. I have drawn from various writings of my own and compiled this, hoping that it would be of interest to all research students in some ways. I also hope that the article will help students to gauge what they are committing themselves to. This may encourage and discourage at the same time. Those who come through will often be more prepared than earlier.

Jumping into research (into a formal registration) is as easy and pleasant as getting married. The tough task emerges afterwards, to get along smoothly!. An unprepared, thoughtless and hasty research registration will very likely meet with natural failure and hold up an opportunity for some other PhD aspirant, more ready to commit. You are also likely to end up displeasing your supervisor too, especially if the supervisor has a queue of aspirants.

RESEARCH- MULTIPLE PERCEPTIONS

What is research? Let us start with the some Wiki-wisdom.

> Research, From *Wikipedia, the free encyclopedia*
>
> **Research** is often described as an active, diligent, and systematic process of inquiryaimed at discovering, interpreting, and revising facts. This intellectual investigation produces a greater knowledge of events, behaviors, theories, and laws and makes practical applications possible. The term *research* is also used to describe an entire collection of information about a particular subject, and is usually associated with the output of science and the scientific method. The word *research* derives from the obsolete French **recherche**, from **rechercher**, to search closely where "chercher" means "to search" (its literal meaning is 'to investigate thoroughly')

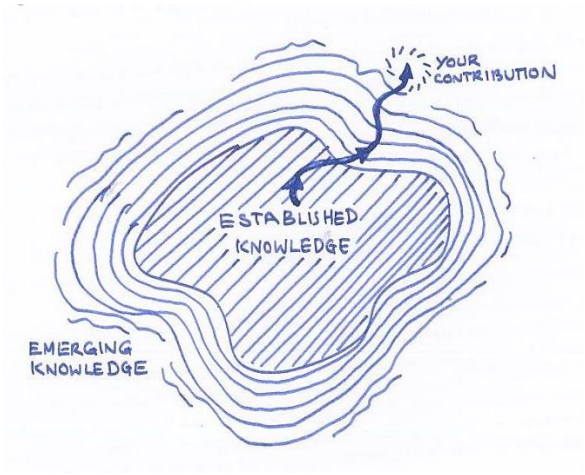
I personally view research as *Creative questioning* and *Critical answering*, the latter being a reference to conscious or subconscious adoption of the classical scientific method ('Scientific method' is not restricted to science, it is a method applicable in most research in all fields, with careful exception of some research which deal with aesthetics). One of

[2]Prof. Achuthsankar S. Nair, Dept. of Computational Biology & Bioinformatics, University of Kerala.

my research colleagues, Biji C.L. reflects on research as follows: (i) Research is a scientific art of developing fresh insights in any branch of knowledge and (ii) Research is a creative fostering for translation of ideas into fruitful results. According to C.Wiidt, "Research is a method for discovery of new knowledge by which the present body of organized facts is augmented." Ultimately, you must attempt to gauge for yourself what research is.

Let us first see how a conventional project and a research project are different. Graduate (bachelors) and to some extent, postgraduate (masters) education are centered around established knowledge which are well documented and have become text-book material. Irrespective of originality, project at these levels give students new experience. But originality/ creativity is not often demanded at this level. This is exactly where research project differs – originality and creativity are at the core of research.

A research work is primarily centered on *emerging knowledge.* These invariably exist in the tens of thousands of pages of journals that are published worldwide every month. It might be good to visualize the more or less static established knowledge that is surrounded by the dynamic emerging knowledge, reminiscent of ripples always moving out. Your interest is to swim from the centre towards the periphery and make your own ripples at the periphery and further them a little bit, as a contribution from you.

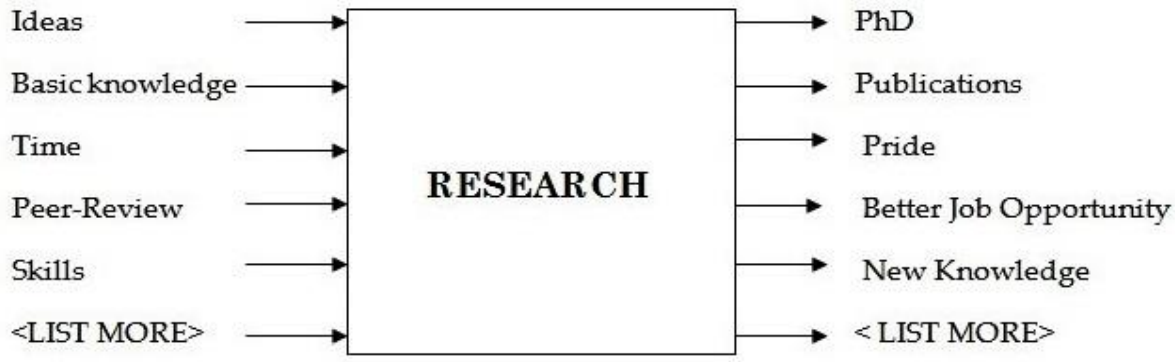


Research, taking a tiny $\boldsymbol{\Delta x}$ step forward, all on our own (as the Google scholar says: *Standing on the shoulders of giants*) adds a new drop to the ocean of knowledge. When you finally do come out with your original ideas, and look back, you should be able to see a path that has finally emerged behind you, going back to the core of established knowledge.

I must hasten to add that the Δx metaphor of research or incremental approach in research is not always true, but very common. Such research targets on improvising an existing solutions. Innovative research is in contrast with it, and does not directly build

on existing knowledge, but breaks new paths. When Edward Jenner (1796) developed the small pox vaccine, he did not have any established knowledge to improve or extend upon. Innovative research obviously has more stakes and always besieged with failures. That reflects Thomas Edison's famous quote- "Genius is 1% inspiration and 99% perspiration".

Engineering often model systems as black boxes with inputs and outputs. It will be interesting to think of research as a black box and list inputs and outputs for the same. Here are my thoughts. You may modify and enrich it and discuss and debate it.



RESEARCH SKILL: Think Smart: Creative thinking

Creative thinking is thinking that is: Richer, Diverse, Unique, Different, Beautiful, Surprising, Attention grabbing, Divergent, Elating, Playful, Spontaneous, Out-of-the-box. Creative thinking is the process of generating new and useful ideas in any sector of human activity: arts, science, politics, daily life, human relations, living styles etc. Creativity is not restricted to poets, painters, musicians, writers and cinema directors; it is applicable to every single person in any sector. Creativity is considered as lying in the right hemisphere of the brain along with feelings, emotions and senses, while logic, reason and numbers lie in the left hemisphere.*"To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advances in science" – Albert Einstein.*

Innovation & Creativity: Innovation is creative thinking to solve problems which have business potential or social value. Improving water taps to reduce loss of water is an innovation with business potential. Communicating how to make home-made bio-pesticide is an innovation with social value.

Creativity & Craft: Craft is the basic skill in a sector, like the skill to sculpt on wood, the skill to sing, the skill to lay bricks. Anyone with these skills need not be creative, but skill is required to express creativity. Mason has craft of house making; Architect has creative

skills to visualize new buildings. A singer has the craft for singing, but the music director creates the music. (Of course there are music directors who are also singers, then craft and creativity exist same person).

Triggering Creative Thinking: (i) Freely making wild and crazy suggestions. (ii) Producing 25 different solutions to any problem (I recommend this as the most important one). (iii) Not judging ideas as good or bad, early in the process. Fear for bad ideas kill creativity (iv) Allowing yourself to play with an idea whilst you travel (v) Drawing or painting ideas. (vi)Sitting in a different place & thinking about the problem. (vii) Listening to different music. (viii) Interacting with different people. (ix) Askinga number of questions. (x) Ignoring what others think about your ideas.(xi) Trying new things. Visit a beach, go to a village or eat new food. (xii) Brainstorming with your family or friends.(xiii) Doing yoga/exercise (xiv) Playing a game, and then coming back to the problem. (xv) Enjoying nature. (xvi) Doing something else for a while (watch a movie), and then going back to your project.

Creative questioning: Research is another name for creative questioning. You must break out of the traditional mindset of stereotypical questions. Here are some questions you can call creative/curious/crazy/wild/nerdy… (i) Why is electricity supplied at 50Hz? Why not at 49? 51? 50234? (ii) What will happen if all people on earth converge at a spot and jump together? Will it shake earth? (iii) What will happen if all Universities and Colleges are closed for a year?

Lateral Thinking: Edward de Bono coined the phrase "lateral thinking" as a counterpoint to conventional or vertical thinking. In conventional thinking people go forward in a predictable, direct fashion. Lateral thinking involves approaching the problem from new directions – literally from the side.

Brain Storming: Brainstorming allows every member of a group to offer suggestions without criticism.

Approaches that kill creativity: Early criticism, company with people who are not excited with new ideas and who begin their responses with " No…" or "But…", instead of "Wow…", "Great….".This does not mean there should be no criticism. Criticism should be at a stage of selecting and implementing ideas, not in the stage of formation.

RESEARCH SKILL: Think Deep: Critical Thinking

Critical thinking is Logical, "Correct", Closer to truth, Deep, Understanding, Unbiased, Factual, Scientific, Convergent, Smart… Here are some popular definitions (Their sources are acknowledged):

- Critical thinking is the art of analysing and evaluating thinking with a view to improving it.
- Critical thinking is the ability to think clearly and rationally about what to do or what to believe. It includes the ability to engage in reflective and independent thinking.
- Critical thinking is thinking that assesses itself"[3].
- Critical thinking is the ability to think about one's thinking in such a way as (i) To recognize its strengths and weaknesses and, as a result. (ii) To recast the thinking in improved form" [1].
- Much of our thinking, left to itself, is based, distorted, partial, uninformed or down-right prejudiced. Critical thinking is, self-directed, self-disciplined, self-monitored, and self-corrective thinking. It requires rigorous standards of excellence and mindful command of their use. It entails effective communication and problem solving abilities and a commitment to overcome our native egocentrism and socio-centrism[1].
- Critical thinking involves asking questions, defining a problem, examining evidence, analyzing assumptions and biases, avoiding emotional reasoning, avoiding
- Oversimplification, considering other interpretations, and tolerating ambiguity, Critical thinkers will change positions when reason leads them to do so.

Center for Critical thinking proposes that critical thinker should have [2]

- ***Rationality:*** *(i) Rely on reason rather than emotion. (ii) Require evidence, ignore no known evidence, and follow evidence where it leads (iii) Are concerned more with finding the best explanation than being right.*
- ***Self-awareness****: (i)Weigh the influences of motives and bias (ii) Recognize our own assumptions, prejudices, biases, or point of view.*
- ***Honesty:*** *Recognize emotional impulses, selfish motives, nefarious purposes, or other modes of self-deception.*
- ***Open-mindedness:*** *(i) Evaluate all reasonable inferences (ii) Consider a variety of possible viewpoints or perspectives.(iii)Remain open to alternative interpretations (iii)Accept a new explanation, model, or paradigm because it explains the evidence better, is simpler, or has fewer inconsistencies or covers more data (iv)Accept new priorities in response to a re-*

[3] http://www.criticalthinking.org/pages/defining-critical-thinking/766

evaluation of the evidence or reassessment of our real interests (v)Do not reject unpopular views out of hand.

- ***Discipline*** *(i) Are precise, meticulous, comprehensive, and exhaustive (ii) Resist manipulation and irrational appeals (iii) Avoid snap judgments.*
- ***Judgment*** *(i) Recognize the relevance and/or merit of alternative assumptions & perspectives (ii) Recognize the extent and weight of evidence.*

A well cultivated critical thinker: *(i)Raises vital questions and problems, formulating them clearly and precisely (ii) Gathers and assesses relevant information, using abstract ideas to interpret it effectively (iii)Comes to well-reasoned confusions and solutions, testing them against relevant criteria and standards (iv)Thinking open mindly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences (v) Communicates effectively with others in figuring out solutions to complex problems*[4]*.*

By contrast, passive, non-critical thinkers take a simplistic view of the world[5]. (i) They see things in black & white, without recognizing variety of possible understanding. (ii) They see questions as yes or no with no subtleties. (iii)They fail to see linkages and complexities (iv) They fail to recognize related elements. (v)They take an egotistical view of the world (vi) They take their facts as the only relevant ones. (vii)They take their own perspective as the only sensible one. (viii)They take their goals the only valid one.

Here are some creative questions I suggest for you to ponder over: Think of the world where there is/are

(i) No Police (ii) No Democracy (iii) No Bees (iv) No Trees (v) No Houses (vi) No Money (vii) No Computer (vii) No Mobile phones (viii) No Electricity (ix) No ownership (x) No Currency (xi) No Gender (xii) No Universities & Colleges (xiii) No Schools (xiv) No Temples/ Churches/Mosques (xv) No Political Parties (xvi) No Petrol (xvii) No Cement (xviii) No name for people

RESEARCH SKILL: Reading

You should read selected papers which catch your fancy, many times, even 10 to 20 times. Remember that a research paper represents emerging knowledge and hence you must not read it as a final word. Look for gaps, areas in which improvement can be brought. When you read, make notes on the margin, underline important points, put question marks on points that don't make sense, and on the top of the first page, jot down couple of lines of your general comments about paper. Make a brief note summarizing and critically commenting on papers, after reading it (you can write it in the paper itself). Learn to

[4] http://www.criticalthinking.org/pages/critical-thinking-where-to-begin/796
[5] http://www.criticalreading.com/critical_thinking.htm

quickly browse and make preliminary judgment. Tile, abstract, introduction and conclusion could be the first focus of reading. Writing a review of key papers in your area of your research could be a good starting point for your research.

Google Scholar covers peer-reviewed papers, theses, books, abstracts, and other scholarly literature from all broad areas of research. You'll find works from a wide variety of academic publishers and professional societies, as well as scholarly articles available across the web. Go to //**print.google.com** and search for books in your area, both advanced as well as basic.

RESEARCH SKILL: Articulating

I personally believe that you should always articulate any problem that you face (we all do that in real life. When we share our problems with near and dear ones, we get a relief) When we articulate a problem or piece of knowledge in our words, we understand it better. Try articulating in your own words whatever you struggle with. Writing daily diary/blog on your research problem could be one way to do that.

RESEARCH SKILL: Facing Questions and Critical Comments with Grace

A research scholar should look forward to questions and critical comments. Take them as paths for improving your understanding and not as unpleasant and unfriendly attacks on your scholarship. This is difficult, but has to be acquired.

RESEARCH SKILL: Managing Confusion

A researcher should be comfortable with unstructured situations. All decisions on problem, approach and judgment are ad hoc and continuously undergo changes, including sometimes going back to abandoned ideas. This could be frustrating, but manageable if you realize that, is very normal. If what you are doing is very clear and systematic, it is possibly not research.

RESEARCH SKILL: Time Management

If you want to manage time, you should have sufficient time at disposal. That is, you must create enough time and then manage it well. **How does one create time? Sacrifice non-priority engagements:** (you can't be reading 5 newspapers every day and watching dozens of movies every week and expect to do quality research). Kill some non-priority engagements and create time for research. Unless you reorganize your routines judiciously, you cannot extract time for research. On each and every routine activity (starting with watching TV serials and reading thrash – these not only eat up your time, but saturate your information system – where are you going to load in your memory the working drafts of the paper that you are trying polish) a researcher needs to ask – Can I

avoid this for the sake of my research? Of course, all the above need to be done applying common sense. Sometimes a melodrama on the television might be what you badly need to take a fresh look at the paper. **Passion creates time:** People in love always have time for each other. Passion ensures this. The big question is how to create passion. I have no definite answer. Your guide or mentor or some guru will hopefully trigger it. Guru could be a book or an experience. **Planning in quality time**: You could do things in a mad rush, it is fine, but plan that day (may be in early morning) and prepare as best you can. Have a list made along with major aspects to be addressed. When you do planning, ensure that you are undisturbed. **Avoiding PC & Mobile Phone**: Don't always sit in front of PC ! An internet joke reads: A bus station is where the bus stops, a train station is where the train stops and a work station is where …. ! (Don't be a spoilsport, 'buses do start from bus stations'). The point should be well-taken. Sitting in front of a PC, especially net-connected, gives you an illusion that you are "working". The internet can keep dragging you endlessly, in an unplanned way, to one thing after the other, which may not have anything to do with your research. There will be temptation to check your emails, say, every 0.05 minutes, then there are cricket scores, games, attention-grabber emails, news papers, Google talk, orkut, and what not, constantly vying for your attention. Observe "away from PC day". Mobile phones are more distracting than PCs. Learn to manage it.

RESEARCH SKILL: Time & Hard work

At home, people have varying commitments – *you need the support of your family to be spared for research*. As work progresses, you may need to make special arrangements for longer slices of time. I need to add here something about "part-time" research. Let me tell you, there is nothing called part-time research. It is a technicality. Those who choose this option usually find it difficult to deliver until the inputs are consciously and eagerly drawn up.

RESEARCH SKILL: Procrastination Management

Procrastination, keeping postponing tasks unendingly, is a common problem with all and researchers are no exception. I think that the main reason is that the task is too big to finish too soon. (Sometimes it is unpleasantness of the task, like going to the dentist). If I decide that I will write a book, it is likely to be not done immediately. If I decide that I will decide the title of the book tomorrow, I will decide titles of chapters day after, I will decide section headings of first chapter on the 3rd day, first paragraph of first section of first chapter on 4th day…. This is likely to work than staring at the whole task of writing

the whole book. Try it. It really works. Perhaps it is the same wisdom as in "*Payye Thinnal Panayum Thinnam*".

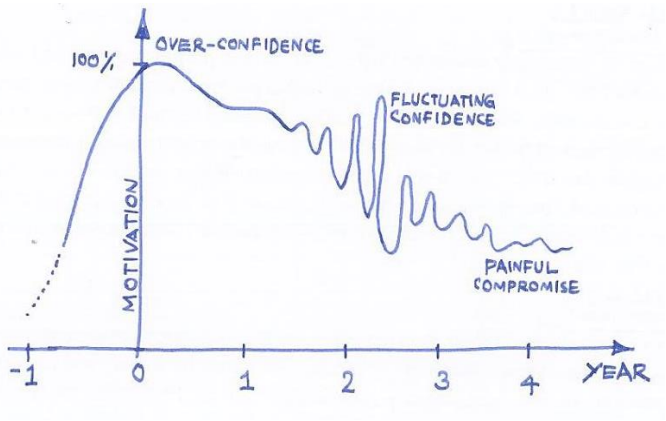
RESEARCH SKILL: Document Management

Now-a-days almost every one drafts their research papers or thesis chapters as computer documents in Word/Linux Open Office Writer. A critical researcher will surely be writing and rewriting many times. Unless documents are managed properly, they could drown us. Ensure that all documents are versioned and dated while saving in computer. "V1 Chapter1 3rd January 2018.doc" is an example. Important thing is that the file name must be inserted in the file as header or footer to connect the soft copy and hard copy. Newer version should be numbered as V2, V3 etc. If minor corrections are made, you can use numbers like V1.1, V2.3 etc. Always correct in hard copy by hand before transferring into the soft copy. Time sensitive guides may ask you to highlight your latest edits in color. Keep all your drafts in a folder.

Managing your Guide: Here is a strange theorem: If your supervisor is very kind, then your supervisor is not very kind. Consider yourself lucky if your supervisor pulls you up once in a while, and demands work promptly and give you deadlines, as this pressure is a great catalyst for your work. Do not feel bad, it is nice to develop sensitivity towards the supervisor's demands. And if you feel guilty that work is not moving, remember, this is also a catalyst! Unless you are thinking about (or worrying about) your research problem on a daily basis (and consequently working on it as the thoughts trigger), you have not reached the pinnacle of your research activity. It is the nature of some research scholars and some guides to keep their work as a top secret. Perhaps some special situations may demand that, but I do not recommend this in general. In the spirit of open knowledge, splash your papers around, hoping to get comments on them which you can use. Have a website or blog where you constantly exhibit your wares.

Motivation Management

I recall that when I was a student in an international campus, the students Union there gave a "Student version of Research Handbook". They had a graph of motivation of PhD students. I can still recollect it.



Realize that it is quite natural to have wavering confidence. It may come from unreal settings of goals and natural setbacks in research. You need to be obviously self-motivated to carry on 3-4 years of hard work and putting up with frustrating rejections from journals (balanced by the occasional joys of recognition). Research scholars who have completed their work may unanimously tell you that they would have experienced swinging moods. One day you feel - everything is going great, my paper is top class, my work is a significant contribution – and pat yourself on the back with pride. There are then these gloomy days when you are shaken, hopeless and frustrated (very often a PRS – Post Rejection Syndrome) and you keep getting these negative thought – *oh I did such a tiny work and thought much of it – see the journal reviewer saw through that – my work so far doesn't matter at all – I know that – where am heading to?* You have to manage this mood swing. Remember that it is quite normal for this swing to happen when you are trying to rate your scholarship internationally.

Getting rejection from top quality journals is often a painful experience for research scholars, especially when facing it for the first time. I do not wish to write about it myself. Sreenadhan, my friend and also research colleague, with a touch of the poetry that sleeps deep within him says: *Every researcher has (an often untold) story of rejections and long long periods of impatient waiting, matched only by the experiences of lovers and creative writers. For example, for the past four months I am waiting for an editor to say an yes or a no to a paper. I have sent some reminders. No reply. No reply. Now I am (im)patiently waiting. Once I had sent a paper to IEEE Transactions on Computational Biology, (certainly a courageous act !) and though rejected, I got an excellent review (of the three referees, two rejected it and one said, there is something in it, but should be revised, but any way majority was for rejection!) the rejection was heartbreaking for me not just because it was rejected, the referees did a ruthless dissection of my paper and it then dawned upon me that I am a child in this field. For three months, Oh, I am telling you the truth, I was down (My guide was kind enough to tolerate my silence and of course I thank him very much for bringing me back). Later also there were rejections but never I was*

dejected by a rejection. (There was an occasion when the rejection seemed to be quite unjustifiable, as the referees did not try to understand the paper). Then acceptances also came by my way (every dog has his day). I may add that Sreenadhan's paper settled for an Indian journal but has attracted over 100 citations. So, the moral of the story is that rejections are universal and acceptances are exceptions. Remember that Fourier's basic paper on Fourier series was rejected by French science academy by a jury consisting of none other than Laplace, Legendre and Lagrange.

RESEARCH SKILL: Maintaining a Research Diary: You must maintain a **research diary** in which you must note down any of your research activities, even wild ideas, and points which arise in your discussion with supervisor, including emails. This must be kept open for note taking when you meet supervisor or peers.

RESEARCH SKILL: Peer Review: Your supervisor is the first person to give you a comment on your work. A more important feedback is when 2 or 3 anonymous reviewers comment on your paper submitted to a top-class journal. **Peer review forms a very, very important input to your research even when the paper is rejected**. They can put your work back on rails, when it is heading nowhere, and give you precise action points. If you are well networked with other researchers and research groups, they might also give comments on request.

RESEARCH SKILL: Mainitaining quality in Research: One easy way to ensure quality of research is to try for a publication in a top journal. However, do not go by meaningless norms such as whether journals have ISSN or it is approved by UGC etc. Every senior academic knows which are the most excellent journals. Even if your paper get rejected from top class journals, it is better than acceptance in mediocre or predatory journals.

RESEARCH SKILL: Interdisciplinary Thinking: Look at the following scenarios: **(i)** When Darwin proposed theory of evolution; it was widely debated by scientists, religious leaders (creationists) and philosophers. Today the debate has transformed. Anyone can confirm the signs of evolution with an experiment on his/her own blood. From blood, science can derive human DNA and then one can search for similarity of it is the Google of biology -BLAST- and see hits of Orangutan and Chimpanzee coming up instantly! **(ii)** Ethics was once a subject of not much consequence to scientists. But today, science finds as its stumbling block its inability to answer many ethical issues raised by scientific development. Ethnical, legal and social issues are of utmost concern to modern science today. **(iii)** The authorship of debated works of Shakespeare or Kalidasa of Bhasa was once a matter resolved through arguments based on history and linguistics. Today such

debates are also realm of mathematics. Mathematical measures of literary style have been developed in a field known as *stylometry*.

Today much knowledge emerges in the periphery of existing knowledge. There are many areas which can be pointed out as "inter-disciplinary": **Bio-Chemistry** (Biology & Chemistry), **Nano-Science** (Physics, Chemistry & Botany), **Linguistic Computing**(Linguistics & Computer Science), **Ayur informatics**(Ayurveda & IT), **Agro-Economics**(Agriculture & Economics), **Audio Engineering**(Music & Technology), **Animation** (Fine Arts & Software), **Drug Design (**Biology, Chemistry, Physics, Mathematics), **IPR in Technology Sector**(Law, Science & IT), Machine Translation (Language knowledge & Computing), **Bio-ethics**(Bio-technology & Philosophy)

Subjects, Departments, Streams, Faculties….There are many ways for a University student to "distinguish" himself or herself from another student. It is common to hear sectarian stands stereotyping each other with judgmental comments such as : "Scientist have no sense of aesthetics and are far removed from day-to-day problems of society"; "Studying language and literature has no utility and is an arm-chair activity"; "Social Sciences have no rigour or scientific basis". Perhaps this is not phenomena limited to academics. "Poetry is the anti-thesis of science", said Coleridge. Malayalam cinema has the famous character played out by Thilakan in "Sphatikam," who felt that technology was inferior to Mathematics and that every throb of the Universe arises from mathematics. Such regimented viewpoints of knowledge and innocent prejudices are behind the academic systems that we practice. We often hear of untouchability between subjects, of Physics student not being able to pursue studies in Chemistry, of biotechnology student not being able to teach Botany, of Electronics student not being able to do research in Information Technology, etc. The prevalent modern view of knowledge is definitely not that of 'untouchability', between subjects, but one that promotes 'inter-caste' marriages.

Knowledge in the academic perspective is often seen as three major streams (there are slight variations in these stream definitions, across Universities and countries):

Stream	Faculties (Subject groups)	Example subjects
Science & Technology	Science, Engineering & Technology, Applied Sciences & Technology	Physics, Chemistry, Bio-technology, Ayurveda, Homeopathy, Computer Science, Civil Engineering, Nano-technology, Electrical Engineering, Geology. Modern Medicine, Alternate Medicine, Agriculture.

Social Science	Social Science, Commerce, Education, Management, Physical Education	Economics, Sociology, Management, Accountancy, History, Archeology, Psychology, Education, Philosophy
Arts & Humanities	Arts, Oriental Studies, Fine Arts	Music, Malayalam, Tamil, Russian, Linguistics, Sanskrit, Fashion Design

Science & Technology: This stream deals with understanding and use of natural phenomena. Natural phenomena are in existence in nature irrespective of presence or absence of human society. Apples keep falling down according to law of gravity, even when no humans are there on earth. In contrast, 'Consumer Surplus' or 'Bloom's taxmony' or 'Cinema' does not exist in the absence of human society (Whereas science tries to study universal principles of natural phenomena, applied sciences and technologies tend to use them to solve day-to-day problems like making medicines, computers, bridges, paints and rockets. This distinction need not be so clear cut, except in cases of highly abstract subjects like mathematics). Though sciences try to unravel knowledge for the good of the society, they are often criticized for their lack of human touch and absence of aesthetics, which may be partially true. There are also instances of discoveries in science pursued without full regard to its threats. Genetic modification, dangerous pesticides, nuclear energy are examples.

Social Sciences deal with phenomena that arise out of the actions and interactions of human beings (society). If there were no human societies, would there be 'principles of management'? Would there be history, politics, religion, ethics, journalism, marketing, tourism, education, research…? (one could say migrating birds would still 'tour', birds would 'teach' their little ones to fly, animals would have 'jungle raj' politics…. but, surely they are no match for the sophistication that humans have in these areas). Unless social sciences are taught, researched and practiced, human society's understanding of itself will suffer and there will be chaos all around.

Arts and Humanities deal with all that human beings do in the space of imagination, characterized by a sense of beauty (aesthetics). Like social sciences, these cannot be completely taken out of human context. Ability to create a world of imagination distinguishes man from animals. There would be no developed language, literature, humour, sophisticated music, sculptures, cinema, poems etc. without human society. A world without poems, literature, dance, music, painting and sculptures would be a dangerous world where science will be of no use, because people will be no different from animals. Arts and humanities wake up our 'human' self; make us appreciate humanity, beauty, truth, justice, equality, kindness….

A look at the above scenario regarding the three major streams should temper our healthy respect of all the three streams. They are both interdependent and complementary and together establish the modern knowledge landscape.

RESEARCH SKILL: Reviewing a Paper: You stand to gain immensely by donning the mantle of Reviewer, as early as possible in your research life. If you submit papers to top journals, they might invite you as reviewers in future (even if your paper was rejected!). If you are in touch with other research groups, they may also suggest your name as reviewers (some journals ask authors to suggest reviewers). More likely, your supervisor may ask you to help him in a review assigned to him/her. Grab the opportunity earnestly. Read the excellent "Ten Simple Rules for Reviewers" by Philip E. Bourne and Alon Korngreen.

RESEARCH SKILL: Using Digital Media: Social media is not merely for fun and friendship. They can be used for taking research forward. Seeking multiple views on your hypothesis can be done over digital media like facebook. Mail groups are another excellent way to benefit through connectivity. In computational biology, the Bio Bulletin Board is an excellent option. There are thousands of researchers and professionals all over the world hooked on to it. You can regularly see conference announcement, questions raised by some and answered by many. You can also throw questions and see myriad responses. Over a year, 99% of the mails may be irrelevant, but the rest 1% is worth the wait. **Subscribing to Table of Contents (TOC)** is also a very good idea. Most journals today have this service. Try to sign up to the TOC of a few journals. Some of them let you get citation alerts, which are emails which report when a paper of interest to you is cited by new authors.

Appendix

Research Docket for Ph. D Students

Regular documentation is required to ensure meaningful monitoring and management of any research process. Please use this docket or suitably modified format in consultation with your supervising teacher. It will be very helpful for you to submit this docket to your supervising teacher every 3 or 6 months.

Docket Submission Details

Serial No. of Submission	*Date of Submission*	*Dated Signature of student*

1.	Name of Student:
2.	Name(s) of Guide(s):
3.	No. of Months elapsed after Registration:
4.	List 5 keywords to describe the research problem:
5.	List (briefly) 2 papers in the last 3 years which directly relate to your research.
6.	List 5 areas of basic knowledge that are directly related to your research.
7.	List 5 tools/ skills required to do the research.
8.	List 5 prominent researchers in the field who are currently active in the area?
9.	List 5 journals in which papers of this area are appearing
10.	List some books which deal with basics of your research area.
11.	List 5 upcoming conferences which focus on your area of research (*with dates, submission deadlines etc.*).
12.	List 5 strengths you have to do the chosen research
13.	List 5 areas of weakness in doing this research (*also say how you propose to overcome them*).
14.	List 5 possible titles of papers that you could publish on your topic.
15.	List 5 possible titles of your thesis.
16.	List the possible titles of your thesis chapters.
17.	List 5 challenges you envisages in research.
18.	List 5 deliverables of your research.
19.	Write in one sentence the up-to-date Synopsis of your research.
20.	Write in one paragraph (4-5 sentences), the up-to-date Synopsis of your research.

21.	Write a synopsis of your research in one page, including your publications so far.
22.	Attach hand out/print out of the following PPTs. Indicate version and date in the first page.(i) 1 slide PPT describing your research (ii) 3 slide PPT describing your research (iii)10 slide PPT describing your research.
23.	Tasks accomplished so far and tasks planned for next two months.
24.	What are some of the issues (*intellectual as well as otherwise*) you face in research? (*Also mention personal circumstances which prevent full output.*) Rate your motivation level now: ◎◎Poor ◎◎Average ◎◎Good ◎◎Very Good ◎◎Excellent
25.	Is there some specific query/request that you wish to make to your guide?
26.	Are any of your papers under submission/review completed? Give full details.
27.	Papers or Books read in the last two months with a 2-3 sentence comment in your own words and also mentioning the open questions identified.
28.	Are you preparing any paper now? How much is it complete? How many versions have been done so far?
29.	Lectures/ Conferences/Training attended with 2-3 sentence summary/outcome.
30.	Write an appreciation of your work during last 2 months.
31.	Write a criticism of your work during last 2 months.
32.	Describe your recent library usage (Key subject books you read, Key non-subject books you read and Key online resources you read)
33.	Describe your internet usage (Daily hours of computer usage, Time for non-research usage and Do you observe 'Away from PC Day?')
34.	Details of peer discussions held/Expert Feedback you received (minutes expected as Appendix).
35.	Guide's notes and overall directions/comments with Dated Signature of Guide
36.	Date, Time & Duration of next discussion meeting:

D3.Academic Language: Principles and Techniques[6]

1. Introduction: Mothers often warn us "don't get wet in the rain, you will get the fever". Mothers, you, I and everyone know that getting wet in rain results in fever. This is a piece of knowledge. More specifically, it is a part of everyday knowledge. We have been attaining this type of knowledge by our everyday general experiences. However, how do the water drops on our head cause fever? The answer lies in specialized knowledge. We would not get specialized knowledge only by general experiences. Specialized experience is necessary to get specialized knowledge. These types of specialized knowledge are called scientific knowledge. All sorts of special efforts towards getting this specialized knowledge can be called research in general. Activities related to research including the dissemination of the knowledge of research all together are generally termed as academic activities. Those who are engaged in these academic activities are called academics or academicians. Language is used in a peculiar way in these academic activities. For instance the language of "don't get wet in the rain, you will get fever" by mother and an explanation of how rainwater on head constitutes fever by a doctor or a scientist is structurally and substantially different. The latter one is a peculiar use of language. This is called academic language (henceforth AL) or language of scientific communication.

1.1. Structure of this article: This article is about the basic linguistic features of the academic language. Three points are discussed in this article. Firstly, how academic language is possible in principle? Secondly, technical features of academic language have discussed. Thirdly, basic techniques through which the academic language is constituted in our everyday language is introduced.

1.2. Limitations: This article is not about the skill in the academic language. Competence in AL cannot be attained by reading or attending an article. On the contrary, this is an aggregated or a supplementary skill resulted by the consistent research in a chosen field of knowledge. This is not a specialized linguistic skill. Therefore, this cannot be attained by an isolated soft skill. Competence in AC, in fact, is a linguistic performance of consistent research experience. Therefore, consistent research experience is a prerequisite for excellence in AL. The point of discussion of AL language is the academic communicative competence which is exclusively resulted by the consistent research experience.

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[6] P. Sreekumar, Dept. of Dravidian & Computational Linguistics, Dravidian University, Andhra Pradesh

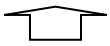
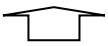
2. The linguistic principle of AC: In addition to the everyday knowledge about nature and society, the human being is phenomenologically endowed with the potential of the multiplicity of different levels of experiences. We are not living in the given world. On the contrary, we are living in different worlds based on our experiences. When we have the multiplicity of experiences we need different types of language to communicate. Academic language is one among such languages to communicate academic experiences. The academic experience is substantially distinct from the metaphysical, mystic and par psychological experiences. It is the intentional, specialized, and methodologically driven experience. We are willing to have it. It is an experience we have reached not fallen in it. For instance, Eratosthenes' experience of roundness of earth is a specialized experience. He willingly reaches towards that experience of the rounded earth through geometric measurement of shadows of the sun. The geometrically designed observations which he consistently practiced him lead towards a special experience in relation to the earth. His experience of the roundness of the earth had to be communicated to the people around him who then believed that the earth is flat. There he needs a special language. It is the AL. AL is possible in our everyday language by using the features of the everyday language. Two features of everyday language make AL possible in language.

The Logical structure of language: Language is logical. The logical structure of language makes language worldly and reasonable.

Revealing nature of language: Language reveals realities. Revealing nature of language discloses and communicates diversified experiences of human which may be different from everyday life-world.

2.1. The logical structure of language: Language is the human species-specific system which can generate an infinite number of expressions by finite means and elements. Unit of expression in language are sentences. These sentences have been using to express our everyday experiences and academic experiences. The logical structures of sentences we use in our everyday communication are different from the sentences in AL. It is necessary to distinguish the differences of sentence and statement to explicate the logical structure of language. Compare to the general types of sentences the truth value is high in statements. All statements are sentences. However, all sentences are not statements. For instance, "There may be rain today" is an ordinary sentence we often use. However, "if there is rain clouds on the south there will be rain" is a statement. Here the two events of the occurrence of clouds on the south and the forthcoming raining are connected as the cause and result by a logical connector "if". These types of statements are termed as conditional statements. Conditional statements are frequently used in academic language.

The logical structure of language makes these conditional statements possible in language. These logical properties of language may not be revealed in the everyday sentences we utter. Grammatical structure often projected in language over the logical structure. The logical subject, object and verb may not be distributed on the places of grammatical subject, object and verb. See the table given below showing logical, grammatical and linguistic realization of an event:

Meaning	Anita plucked flower. The flower plucked by Anitha The flower has been plucked by Anitha
 **Grammatical structure :**	Flower [Grammatical Subject] Anitha [Grammatical Object] Plucked [Grammatical Verb]
 **Logical structure:**	Anitha [Logical Subject] flower [logical object] plucked [logical Verb]
 **Reality:**	ANITHA- FLOWER- PLUCK(ED)

The above presentation shows different levels of the structure of language between the reality and the meaning which is open to different interpretations. Scientists have to use the same language to express and communicate the special experience which she has. There may not be a constant parallel between the logical and grammatical structure of language. It is not at all a necessity in language. Therefore, any type of new reality one experiences different from the generally known and experienced reality can be conveyed by language. Language allows it grammatically. This property of language i.e. the divorce of logic, meaning and grammar makes academic language possible. Therefore, a sentence like "colourless green ideas sleep furiously" which is semantically wrong and grammatically right is possible in any language across the world. In spite of this possibility, a complete divorce of the logical and grammatical structure of language distorts academic language. The new experiences of the scientists may violate the given logic of everyday experience. Even then, to express and communicate experience which is beyond the everyday logic the scientists have to use the given logic on which our everyday life and language are constituted. When we express the scientific experiences like the theory of relativity which is violating the everyday logic of life this becomes a crucial problem in scientific communication. This made Archimedes of Syracuse run by uttering aloud εὕρηκα heúrēka when he experienced fluid mechanics reveal the

symmetry of weight of the fluid replaced by the εὕρηκα heúrēka means I found it. It is a first-person expression addressed to the second and third persons. This is a problem often faces by a mad person whose logical structure at the level of cognition is distorted and a scientist experiencing a universe which is different from the everyday experience. For a mad person he himself cannot come out of from the different experience. However, a scientist is intentionally and systematically entering into such experience. Therefore, a scientist can come out of this experience and document and communicate it with the other. This does not mean that a scientific experience is a psychological hallucination. The point of differences between a hallucination and scientific experience is that the latter can be expressed to the other. Compare to other experiences scientific experience can be communicated not vice versa. Therefore, a second person cannot experience the mystic and psychologically deviant experiences without the internal and external material component which facilitates such experiences to the first person. These experiences more specifically scientific experience is expressed through language. This language is called academic language. More definitely, academic language is what the scientist can and mad person cannot in relation to the expression of experience. Therefore, the chance of misunderstanding a scientist as a mad person is not an exception but expected. Therefore, many scientists had been called as mad during their lifetime. To avoid such misrecognition scientist should have enormous control over academic language. How? Towards that, we have to examine how academic language is encoded in language.

3. Techniques in academic language: Academic language is not a verity of a language. It is not a register as it is generally misunderstood. This is a special stage of language. Academic languages are different in relation to the differences of the representation of human experiences in language. See the given representation below. Here the horizontal level represents the different levels of human experience. Vertical level represents the diversity of human experience. Each type of experience is reaching towards everyday language with different type of academic language. Depends upon the depth and diversity of experiences academic language through which these experiences been expressed also differently distinct from everyday language. The place of AL is between the special experience and ordinary language. Special experience cannot be completely expressed through ordinary language. Therefore, academics should use the logical and revealing potential of language which we have mentioned earlier to express the special experience. Like academic research, this too needs special expertise. This is not just a communicative skill. This is a type of a communication of the special experience you have by using the everyday language. The everyday language works based on the logic evolved by ordinary experience. Consequently, when we use language to express the

special experiences language becomes unusual and specific. The language of literature is such type of language. The imagined experience of the author can be communicated by the characters she created in a fiction. Unlike the scientist, the author has the freedom to create many characters to express and communicate her experiences to the readers. Characters in a fiction altogether contribute towards the successful communication of the experience which the author wants to communicate. Moreover, the language of literature allows the multiplicity of interpretations and meaning by innumerable readings by many. In literature, the freedom of the reader to interpret a text with indefinite meaning facilitates the author free of his text. And, the author does not have any responsibility to tell the reader how she/he could reach the experiences she has narrated in the fiction. Therefore, the author of a fiction is free from the responsibility of convincing the reader how she could reach such experience. On the contrary, the scientific communication is different from the literary communication. For a scientist, it is necessary to tell the reader how could she reached such experience and she should tell how the reader can also reach such experience. Therefore, communication in literature and science are intentionally and functionally different. This difference indicates that academic language has many limitations. The language shall be bound to avoid ambivalence. Therefore it can communicate the reader what the scientists intended in scientific communication. Theses bindings determine the techniques of academic language. Two of the major techniques of academic languages are discussed below.

3.1. Convergence of duality of experiences: Academic language is the resultant status of language when the researchers use the everyday language to communicate the research experience. There are three components in academic communication in relation to language. Firstly, the specific experience of the researcher. Secondly, the general experience of the other to which the specific experience to be communicated. Thirdly, the everyday language functions in between the former two and constituted based on the everyday logic of the later. Here the academician has to face the two types of experience. The priority is to the specific experience. However, the language through which the specific experience yet to be communicated is constituted based on the common experience. How do we communicate the specific experience by using language which is constituted based on the common experience? For instance, you are dipping your hand in a bucket with full of water. You are touching on an object which you have touched never before then and you cannot see it. This is a specific experience for you. How do you communicate this specific experience to other by using the language? The only way is to use a new word. At the same time, it should be understood by the other too. Towards this, the number of such new words has been coining and using in science are called

concepts and terminologies. Majority of the concepts and terminologies of science have formed by making new words of attributing new meaning to the existing words. Newly coined concepts and terminology shall be accepted by the academic communities of each discipline. Towards reaching such acceptance, each researcher should explain how others can get such experience expressed through the new concept. By this process of communication and consensus, new concepts are developing in each discipline. In short, the function of the concept is to converge the duality of experiences of the researcher and the other into one or to converge the specific experience and common experience into one. The function of the concept is the convergence of duality of experiences. These concepts and technical terminologies are the basic techniques of academic language.

3.2. Convergence of *a priori* and *a posteriori* reasons: Common man lives with the common reason of ordinary life. The grammar of languages is also structured based on this common reason. Contrary, the specific experience resulted by research often differ from the common reason. This reason of the everyday life is called a priori reason and the later resulted by specific experience is termed as the posterior reason. A posteriori reason is to be communicated through scientific communication. However, the ordinary language is structured upon a priori reason. Therefore, the scientist is motivated to transcend the ordinary language which has been constituted by common reason. This is the way formulas are developed and explained in academic language. Numbers and algebraic symbols are used in formulas instead of linguistic components. Einstein's formula of E = MC2 which reveals the phenomenon of the conversion of mass into energy is an example of it. The experience of the huge containment of energy in each mass can be represented only by another physical experience of energy. The existence of both cannot be explained by the common reason on which the ordinary language has constituted; may not communicate through language. Therefore, Einstein used the formula instead of language. Most of the specific experiences in science have represented by formulas. These formulas function as a bridge of reason between the specific experience which cannot be communicated through everyday language and academic language. Therefore, it can be stated that formulas are functioned in between specific experiences which cannot be expressed through everyday language and academic language.

4. In brief: We have discussed three points. Firstly, academic experience differs from the ordinary experience. Secondly, academic language is developed by the scientist's effort to communicate their specific experiences through everyday language. Logical structure and revealing nature of language make academic language within the ordinary language. Thirdly, academic language is a status of language; this is possible by two techniques convergence of duality of experience and *a priori* and *a posteriori* reasons. Only general

aspects of academic language have discussed and characteristics of academic languages differ from disciplines. Therefore, specialized training of academic language is necessary for each discipline. In brief, skill in academic language is like a skill in kicking goal in football. It is necessary to play football, then only the skill of kicking the goal arise same as the case of doing research and skill in academic communication.

* *This is a slightly modified version of a handout of the 1st class I have engaged in the two day Workshop on Academic Writing and Communicative Rationality at University of Kerala on 4th & 5th of August, 2016.*

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D4. Evolving Patterns of Doctoral Degree Award[7]

Over the years, the award of PhD has undergone transformation from the traditional PhD, which is based largely on the supervised research project and examined solely on the basis of the thesis, to a doctoral degree programme. Diverse types of doctoral degrees including professional doctoral degree, practice- based doctoral degree, and doctoral degree by publication etc are being awarded by different universities the world over. While the traditional doctoral degree is based solely on supervised doctoral thesis, professional doctorate degree includes significant taught elements with specific learning outcomes and supervised research project which is often smaller than that in the traditional PhD. PhD by publication is also based on a supervised research project but examined on the basis of a series of research publications in the topic of research. Certain institutions award practice-based doctorate degree usually in the area of performing arts where the output involved both written thesis, generally shorter than the traditional PhD , and one or more other components such as poetry, fiction etc for creative writing or performance for theatre studies , music etc. A common requirement across all formats of PhD is a thesis embodying the results of studies carried out in a research project under the supervision of a research advisor/guide. Though the quantum of research component in each format can vary, the requirement for a supervised thesis ensures that the awardee is trained to document the results of the study in a scientific manner.

The doctoral degree programme currently being followed in most of the Institutions as governed by the rules and regulations of the Universities and other degree granting Institutions comprise of multiple components. Research scholars have to successfully complete a pre PhD programme which generally involves course work and evaluation, after which the candidate's registration is confirmed and s/he continues research work for the thesis. On completion of the work, the candidate generally, has to give a colloquium or a pre –submission seminar before a group of experts including the members of the research advisory/doctoral committee. Further, the candidate has to publish his/her research work in peer-reviewed approved journals prior to submission of the thesis. Evaluation of the thesis is done by experts and the candidate has to appear for a viva voce examination which may be conducted by an expert/experts or a public viva/open defence. On completion of such a doctoral programme the candidate is expected to be trained in the use of various tools and techniques of research in the discipline in

[7] *Prof. P. R. Sudhakaran, (Professor Retd.), Dept. of Biochemistry, University of Kerala*

general, and more importantly in the specific area of research, design and implementation of a research project, analysis and documentation of data, manuscript preparation and procedures for publication in research journals and presentation in conferences and seminars. Unlike the traditional Ph D system where training in all these aspects are generally imparted by the supervising teacher, the doctoral degree programme has a doctoral/research advisory committee constituted specifically for each candidate,(of which the supervising teacher is a member,if not the convener) to oversee the progress of the candidate. This change from a research advisor/supervising teacher to a research advisory committee/doctoral committee is interpreted as an effort to provide better scholarly support to the candidate to carry out research. But supporters of the traditional system argue that it is the supervising teacher and not a group who would be of constant support to the candidate throughout the course of the doctoral work.

Another institutional requirement prescribed for the doctoral programme is the publication of research work in approved research journals. In the traditional system it was not considered an essential requirement and the award of the degree was based solely on the evaluation of the thesis. Further ,several Universities insisted that the work was not to be published before the thesis was accepted for award of PhD , in order to ensure originality and authenticity of the research work submitted for the award . Universities often used to insist on its prior approval for publication of thesis and even ask the thesis examiners to give their suggestions and recommendation for the publication of the thesis. But presently, according to the new regulations prescribed by the UGC, in most of the Universities and other degree granting Institutions in India, research publication is an important requirement for submission of thesis for the award of PhD. While some Institutions prescribe at least two publications in peer reviewed approved journals, most Institutions insist on at least one publication. In several institutions, conference/seminar presentation is also insisted upon. In certain cases, faculty-wise differences in the requirement of minimum number of publications are also seen. As a follow up of these developments, each university has an approved list of research journals and insist that only publications in these journals would be reckoned to meet the requirement. The UGC and other national regulatory agencies such as MCI have also published a long list consisting of thousands of approved journals. It is to be noted that prescribing a minimum number of publications as a requirement for award of PhD is different from PhD by publication which is rarely given here.

There are a number of reasons particularly pedagogic reasons favouring the requirement of publications for the award of PhD. Dissemination of knowledge is as important as its creation and the published research articles provide a resource that is

easily shared with others and generate further interest and debate. Publishing research papers as part of the doctoral research programme enables the candidate to acquaint with the process of developing an article for publication in journal, choosing theappropriate journals and formatting the matter accordingly and its submission, responding to reviewers and editorial comments, proof reading and matters relating to publication. It instills discipline in a student's research conduct and ensures that the research question is put in the proper context; scientific methods are properly documented, results are scientifically analysed, documented and discussed. Publication of the research work ensures that its quality is assessed through the peer review system of the journal; this might be an important factor in acceptance of the thesis. Further, it adds to the research profile of the candidate.

There are institutional reasons for promoting research publications. Institutional funding models, particularly of research Institutions and Universities include reward for criterion-wise performance .Increase in number of research publications and doctoral degrees awarded add to the research profile of the Institutions. In the university system, a significant fraction of research publications come from doctoral research and the introduction of the requirement of research publications for doctoral degree programme certainly adds to its research profile. Likewise, funding for research through externally funded research projects also depends on the research profile of the investigating team and the Institution.

Though the requirement of publications appears to have several advantages, it has several limitations. The time required for publishing in a standard international journal is often too long. Certain supervising teachers and research scholars are not keen to publish their work in any low impact journals just for the sake of meeting the requirement of a publication. All the research projects successfully completed for PhD may not be publishable, not because of the quality but because of the nature of the research problem; it is also possible that such research problems though very important may not receive adequate attention under the doctoral research scheme. Certain research studies may be of strategic importance or may have huge translational or patenting potential and the investigators/sponsoring agencies would not want to forego these options by publishing the work. Further, insisting on publications may lead to unhealthy and unethical practices as well as opting for publications in low quality journals at the risk of the reputation of the Institution and the Investigator.

Introducing multiple institutional requirements for the doctoral programme necessitates matching administrative action for compliance of the Regulations. This can naturally take long time and cause delay in fulfilling the requirements, the completion of the work and

award of PhD unless the administration is very responsive and acts fast. One can imagine the administrative burden in a centralized administrative system where hundreds of doctoral candidates are registered every year. A decentralized academic-centric mechanism might be more helpful in avoiding such delays.

D5. On "I don't Know" [8]

Inspiration is not the exclusive privilege of poets or artists generally. There is, has been, and will always be a certain group of people whom inspiration visits. It's made up of all those who've consciously chosen their calling and do their job with love and imagination. It may include doctors, teachers, gardeners — and I could list a hundred more professions. Their work becomes one continuous adventure as long as they manage to keep discovering new challenges in it. Difficulties and setbacks never quell their curiosity. A swarm of new questions emerges from every problem they solve. Whatever inspiration is, it's born from a continuous "I don't know."

All sorts of torturers, dictators, fanatics, and demagogues struggling for power by way of a few loudly shouted slogans also enjoy their jobs, and they too perform their duties with inventive fervor. Well, yes, but they "know." They know, and whatever they know is enough for them once and for all. They don't want to find out about anything else, since that might diminish their arguments' force. And any knowledge that doesn't lead to new questions quickly dies out: it fails to maintain the temperature required for sustaining life. In the most extreme cases, cases well known from ancient and modern history, it even poses a lethal threat to society.

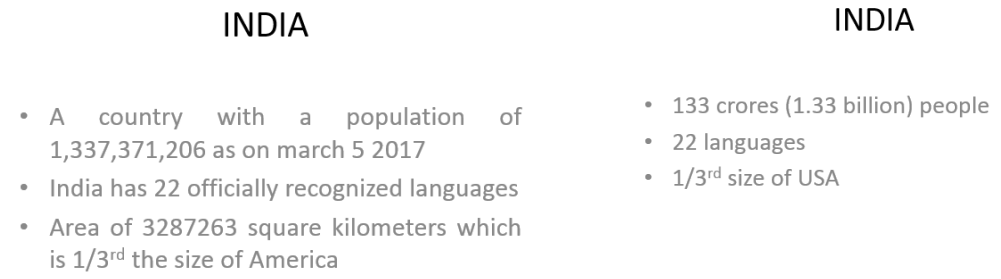
This is why I value that little phrase "I don't know" so highly. It's small, but it flies on mighty wings. It expands our lives to include the spaces within us as well as those outer expanses in which our tiny Earth hangs suspended. Had my compatriot Marie Sklodowska-Curie never said to herself "I don't know", she probably would have wound up teaching chemistry at some private high school for young ladies from good families, and would have ended her days performing this otherwise perfectly respectable job. But she kept on saying "I don't know," and these words led her, not just once but twice, to Stockholm, where restless, questing spirits are occasionally rewarded with the Nobel Prize.

Such surrender to not-knowing, Szymborska argues as she steps out into the cosmic perspective, is the seedbed of our capacity for astonishment, which in turn gives meaning to our existence

[8] "Wislawa Szymborska - Nobel Lecture: The Poet and the World". *Nobelprize.org*. Nobel Media AB 2014.Web.27Dec2017. <https://www.nobelprize.org/nobel_prizes/literature/laureates/1996/szymborska-lecture.html>

D6. Tips on Making Powerful Presentations[9]

1. Open defense is a short span of time where you can showcase your research before all. Many times, I see good research presented in bad and painful way. Please note that a presentation is not a text to be read out. It is a prompt for the speaker to speak and a structure to help listeners to listen. In this article, I discuss some tips for general presentations. You may adapt some of it for open defense also.
2. There is a presenter hidden in each one of you. When your react to some tips that we discuss in this article, each one of you may transforms in your own ways.
3. I am not attempting to teach you the various menus of Power Point Software or the like. We will only speak of the ideas to make the presentation powerful, not the menus and the shortcuts of software's, which I am sure is no issue for most of you to locate and use.
4. Remember, a multimedia presentation is a creative activity. Consider yourself as a film maker or director of a drama. Well then, there must be lot of ideation before you touch your computer and start your presentation software. Make a 'story board' of the presentation on paper first.
5. Text: We first will discuss about textual content in multimedia presentations. The first choice regarding text is what to write, as well as what not to write. Remember, presentation is an aid to a speech, not a transcript of it. Therefore, text in presentation should be a prompt for the speaker and a thinking stub for the listener. It is best to use minimal text. **Imagine that you are required to pay Rs 100/- per word for each word used in your presentation!** Text that fills the screen and in tiny letters is the best way to switch listeners off. If it doesn't, then they will be busy reading the text and not listening to you.



A sample slide showing the effect of reducing textual content

[9] Prof. Achuthsankar S. Nair, Dept. of Computational Biology & Bioinformatics, University of Kerala.

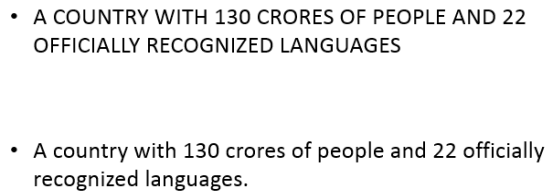
6. Now let me discuss the choice of font for the text. First decision is to select between basic types: Serif and sans-Serif. Serifs are decorative fonts with small lines at the end of the letters. Sans Serif, which means without serifs, are more clean and simple. There is an argument that Sans Serifs are easy to read and more serifs are aesthetic, which are both subjective arguments and also depends on context. If the presentation is on a new-gen topic, perhaps Sans Serif suit well. Please note that when the size of letters is very small, serifs should be avoided.

7. Once you choose between Sans-Serif or Serif, you will have to make up your mind on the specific font for use. Most presentation may have default setting of Arial or Times New Roman. Naturally, adopting them will give you a common look. Try out something different like Garamond, Book Antiqua, Verdana, Baskerville old face etc. Avoid using too complex and gaudy fonts which might reduce readability.

A sample slide showing the selection of fonts

8. Fixing size of fonts is easy when your text is minimal. Please remember, what you see on computer screen clearly may not be so clear when projected and watched from distance. Sizes of 16-24 points may be considered. Anything below 16 may be painful for audience, especially if you have senior citizens, among them. We also need to decide on using capital letters. Traditionally, large amount of text in capitals is to be avoided. Look at any newspaper and see if you can locate large amount of text in capitals. That will convince you. The ups and downs of normal text compared to full capitals, is arguably good for eyes.

Capital Vs Normal Case



9. High lighting of text can be done with Bold, Italics, and Underline and also by changing text color selectively. Over using any of them can be distracting and fail the purpose of highlighting.

Font Highlighting

Earth has enough for every one's need, but not greed

Earth has enough for every one's *need*, but not *greed*

Earth has enough for every one's **need**, but not **greed**

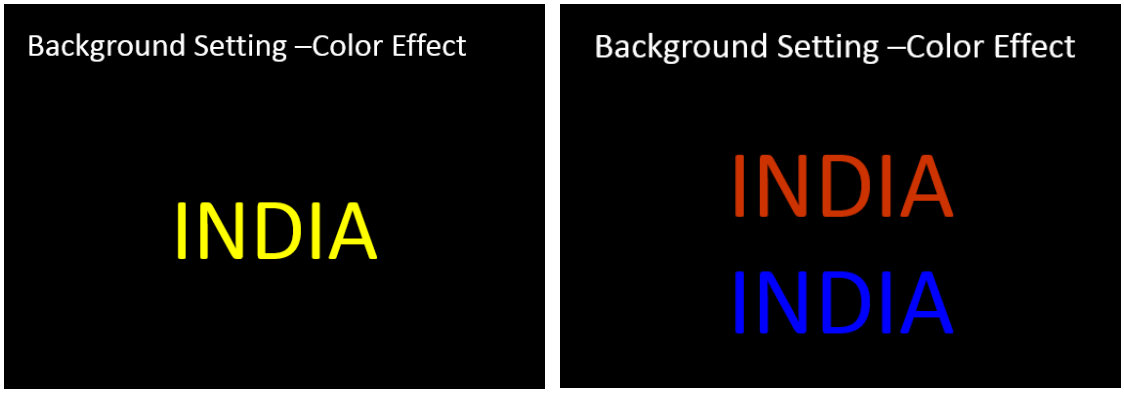
Earth has enough for every one's need, but not greed

10. Presentation packages have many special effects on texts like shadows, emboss etc. Use them sparingly such as in opening/closing pages. Professional presentation does not have much scope for them and in small size they will reduce the readability. Innocent excitement with such special effects may result in amateurish presentations.

Emboss and shade

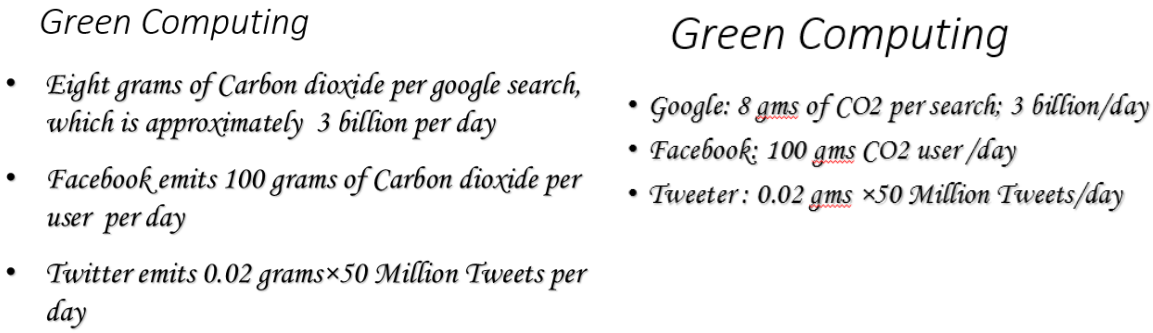
Slide showing the effect of Emboss and Shade

11. Before we discuss of text color we need to discuss about slide background color. Some choose background images, which are faded. They can interfere with readability and are best avoided. If used, they must have some area with homogenous color where text can be placed. If you use single color for background, most common is white. I am a great fan of black as the background color. It reminds one of the good old black boards: white text on black background. It also is philosophically suited for education- we are removing ignorance (black background) with knowledge (white text). The Sanskrit word 'Guru' stands for 'remover of darkness'. If we use black background, the font colors can be white or any light colors. Be careful when you choose dark colors against black. Blue and Red are really bad choices. The letters do not stand out and readability will be seriously affected.



Sample Slides showing Background Setting

12. Text spacing and layout is also to be given attention. As far as possible try not to break a line, Bullets are the norm for presentation. When you use these, consider re-editing your text so that all bullets carry one line of text. Centering or left/right adjustment of text should be decided based as your sense of aesthetics. I like it all left adjusted.



Sample slides showing bullets

13. **Images, Graphics and Video**: I don't need to argue about the inevitability of images and graphics in the modern times. The whole cyber space would reduce to an uninteresting heap of text, if images and videos were not there. Even though you can make a presentation without images that would have to be very creative to make it impressive. The advent of smart mobile phones has endeared most of us to handling images and using it to enrich communication. The social media is possibly got us addicted to images. The mobile phone cameras have put an end to era of monopoly of professional photographers in photography and made every one of us a photographer.

14. Though almost all of us have a mobile camera in our hand, many still pick up images from Google. Where possible, use your own images. Picking up images from Google also may raise copyright issues (It is OK to use such images in class room presentations; but it is not legal to publish the presentations). Use your mobile phone

camera generously. Keep your stock of photos handy. These could be photo of your Department or Lab or Library or your favorite subjects/landscape etc.

15. Putting amateurish photos in the presentation can bring down its appeal. It is wise to seek some help from experts or pick up a few tips from the web on photography. I often find dim lit photos or ill composed photos in presentation. Outdoor photos taken before or after strong sunlight, is ideal. When you use photos of people, try to make them lively. Instead of using passport size photos of each person in your team, an outdoor selfie of all of them together would add life.

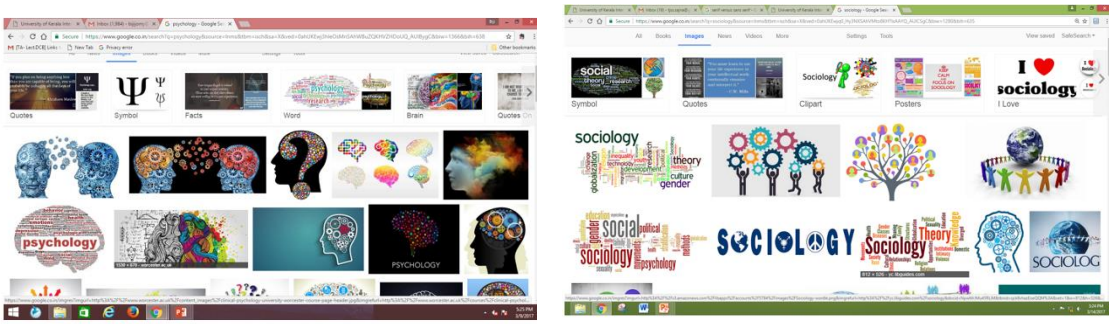
Passport Photo Vs Selfie

16. Once you have photographs of choice, there are two questions you can ask – can I crop away some parts to bring the person or object of my interest to better view? Can I enhance the visibility by using the contrast enhancement or auto correct option in my image software?

17. If you pick a photo from the web, there are chances that it might be of low resolution. Using it might compromise quality of your presentation. This is especially so if you enlarge the photo. Also, be very careful in resizing the photo- you should not do it in a way that affects the 'aspect ratio'. If you pull the image, do it in the corner and at 45 degrees.

18. Is there a difference between photo image and graphics? Graphics is mostly a word used to describe artificially made images like an icon, but this is not always so. While photo images come in JPG or PNG files, simple graphics can also come as GIF files. They are typically not to be resized.

19. One great trick with images is to use google image search result screen as a slide. It gives a non-verbal communication, effectively. 'What is the difference between Psychology and Sociology? Google image search screen tell us the answer in a special way.



Slides showing Google Image search screen as Psychology & Sociology

20. You can add video in presentations and resize them just like you do with images. Long videos might really take the audience off your original presentation. So it is ideal to have tiny clips that score a point. You can mute the sound and give your own commentary which will integrate the content well with your presentation. You may also consider editing the video so that you will confine it to the exact portion of your interest.

21. Soft music can be played in the presentation, if the context is appropriate. MP3 files can be embedded into presentation pages. Loud and distracting music is best avoided. I find it punchy to add a clip of music in my thanks giving slide.

22. Perhaps the most important aspect of your presentation, before it begins, is the Title. This is true about any speech or talk that is announced in advance. I used to give presentations on creativity and used to title it as "On creativity". Later I made a creative change; the title became "Oh God! Do not show me a way", an argument that comes up in the presentation. It hooked up people, they were curious to know what it was all about. Even when the presentation progressed they were eagerly waiting to resolve the mystery. Mind you, it was a conference on electrical engineering. After three decades, I haven't forgotten the talk!

23. I discussed text and graphics as two separate things. I had hinted that creative people can make graphics with text. Typists of the type writer age as well as ASCII artists like Joan Spark could do this. In presentations, a kind of word graphics called 'word cloud' is popular. They capture a subject with words, arranged in different colors and sizes orientations. Right angles are the popular orientation. There are sites which do this, for instance wordcloud.com. You just need to type in words of your choice. I

enjoy hand crafting word clouds by typing the words in an editor and sizing and coloring the words as I wish and then screen capture the text and cropping, rotating and placing them to my satisfaction.

An example for Word Cloud

24. If you are speaking in a seminar or conference outside the University or to an audience of another organization or country, you can add a personal touch by introducing yourself and your organization through lively graphics. "That is me in my office, "That is where I work." "This is my family" are all OK. A 2-3 slide tourism promo of your country is also fine. I have noticed that exactly opposite also works. When I presented in Korea, I showed a few slides of Korean food that I was trying out, Korean actress that Google told me was most popular, a 'Hello' in Korean alphabets. The audience connects to you with personal touch in both the above approaches.

25. You can cleverly use ethnic communication – images or words or action that warm up particular ethnicities. If you Google for flowers, you may get tonnes of them. But they have subtle differences for different ethnicities. In Kerala, Jasmine flowers evokes a subconscious response which no other flower can give: romance. This is cultural conditioning. Food is also similar. The image of cut raw mangoes and salt will immediately cause salivation in a Kerala audience, but may have no effect in Japan. If you carefully observe world culture, you may be able to exploit such ethnic elements in your presentations.

26. How long should be your presentation? Well, I better change the question. How short should be your presentation? Make it as short as possible, if you have a choice. In the modern world where everyone is tuned to heavy interruptions and short attention spans, it is best not to take your sweet time. In the last century, school teachers were

told that the average attention span of students is around 45 minutes. I am sure it might have fallen. Perhaps we should try to not extend our presentation beyond 45 minutes.

27. When slides come in sequence, there is some flow that will aid easy watching. Ensure that your slide show doesn't produce staggering effect. The position and alignment or text, font size, type, style etc, if varying in consecutive slides, can cause staggering. Unplanned staggering which appears continuously across slides would be painful to audience. After your draft presentation is ready, this aspect needs to be checked and adjusted. Some use tabs to show the organization of the slides and for easy navigation. Slide numbers are also good and are helpful to the presenter to gauge the presentation speed and adjust it. Variety of slide transition effects are provided by presentation software. Unless you use them carefully they can become distractions. What you yourself may enjoy when you are creating the presentation may become a painful drag when you actually present.

28. Many start their presentation with a title slide giving title, name and affiliation of the presenter etc. I usually give 3-4 slides before the title slide with the caption "Test Slide". This first helps in the setting- up stage when you don't want actual slides to be revealed. The set up task could be done with test slides alone. Now, there is some hidden science also. If you could choose pictures for test slides cleverly, you can give some brain exercise to the audience and keep them in a receptive mode. Striking color contrast, soothing nature photography, clever play of light and shade, nostalgic images etc. may come in handy. These are especially welcome when your topic of presentation is generally dry. I insert nature photos after every 5-6 slides and title it "Digression". Most of these pictures affect the right brain, whereas the logical and analytical stuff in the presentation affect the left brain.

29. Tables come up in many scientific and business presentations. I think tables are a wonderful way to switch off audience, when not used with care. You may first seriously consider the relevance of tables in the presentation. If you think it is inevitable, tweak the tables to make it painless to read. If table has numbers, decide how exactly you will display them and what accuracy is actually required. In a table comparing population of different countries, in there any point is showing that population of a country as 18734789? It will simply cause data overload in the audience. Wouldn't it be enough to say 18.7 million? Digits after decimal points should be kept minimal, just one or maximum two. You can invite audience to a web site/hand-out for exact figures, if necessary. If there are some patterns to highlight, use

different colors or boldface to do so, rather than let the audience struggle to locate "row 3, column 4"

30. One good technique to sharpen your presentation skills is to do it in an abridged manner. Say what you want to say in 6 slides, 3 minutes. Such flash presentations are very useful in giving the audience a big picture of the concept. Perhaps it is useful to the presenter also, in the same way! The Japanese have a special presentation style called Pecha – Kucha (Chit-Chat). It is a flash presentation, but with pictures alone. It is quite challenging, but rewarding to do a Pecha – Kucha. Go ahead, try one. Zen style is one with high quality images and single words or short phrases. In higher education, that is, in colleges and Universities, education is expected to center around questions. Why not has just one question alone per slide? In certain contexts, such presentations can glue the audience. I suppose, the context has to be chosen carefully.
31. You can sometimes beat latest technology with nostalgia. On my birthday if I get a good old hand written letter, I would be more moved than by receiving hundreds of Facebook messages. You can try this out in presentations too. Use color sketch pens and draw your slides on paper. Finally scan these and produce your presentations. The human touch will stand out, but then, you are missing out on all the conveniences of the digital format.
32. Please do not confine to Microsoft Power Point or Open Office Presenter Software. Some consider software such as Prezi or eMaze to be far ahead of traditional options. Find out yourself. If you are a techy person and in the know of producing animations, you can break out of the bounds of what we have been discussing and produce terrific effects. But these call for specialized skills and approaches.
33. Another thing to know is that the programming language Python can be used to produce presentations in which you can embed your own program code. Such tailor-made presentations are especially useful when techy subjects are presented, but again call for specialized skills. Some of you may know that you can insert certain kinds of programs into you presentation. This is called active content.
34. Whether it is a power point presentation or a mere lecture or a chat, there are certain underlying communication strategies that will help. Don't start with any notion of "difficulty of topic". Great educational thinker Jerome Bruner once said, "There is nothing intrinsically difficult in any subject". It is the way we communicate it that makes it difficult or easy. This could be a good guiding principle for you. Bruner also says, "Anything can be taught to any one in some honest from".

35. When we prepare to communicate, sometimes, we have a stereotype of an audience. Our presentation is subconsciously shaped by that stereotype. Break it, but how? Forcefully imagine that someone else is listening. Your grandparents, a police man, a farmer, a kid, a politician…. It will trigger new approaches and ideas.

36. Another idea is to bring in a touch of life into the presentation. Describing two bonded molecules as husband and wife or electricity as flow of water (with some pictures that suit it), or a matrix of numbers array of marks obtained by children in a school class, (sitting in rows and columns), all make the topic lively.

37. Presenting statistics is usually a very dry task. But creativity can change that. A famous presentation shows the average food consumption across different countries by showing a typical family of that country with a heap of food corresponding to the value in the statistics. How much water is there on earth's surface? If all water sources are made into a ball and kept in one spot, than the earth is like a football and the water ball is the size of a gooseberry. Such useful imageries can communicate very effectively.

38. However good your presentation, its delivery is depends on your personality. If you want to inspire the audience, you must be inspired, in the first place. Use gestures to support your articulation, but do not over use it. Use story telling if possible. It is an established communication tool. Use metaphors, quotes, bit of relevant history, etymology of words etc. to spice up presentations. Finally bring up visual surprises outside presentation, use props to surprise and entertain.

D7. Introductory Data Analysis using R[10]

...theories cannot be verified absolutely and forever; however, they can be falsified - i.e. they can be proven to be wrong - given a certain degree of certainty (or probability)
Karl Popper, The Logic of Scientific Discovery, 1959

1 Introduction

The main objective of data analysis is to derive useful information from a data set to test a hypothesis, disprove theories or gaining insight into the system of collected data. It involves the process of inspecting, cleansing, transforming and modelling data for gaining insight into decision making. The data is the foundation of all derived information, but many a time the available data may be incomplete and contain errors. The data cleaning is the process of correcting these errors. After cleaning, the data may be analysed using a variety of techniques referred to as exploratory data analysis to begin understanding the information contained in the data. The preliminary analysis may lead to further cleaning of the data. Descriptive measures such as mean and standard deviation shall help in understanding the data further. Visualization techniques may also be employed to examine the data. The main objective of this article is to motivate the researcher to carry out data analysis using R (a free software environment for statistical computing and graphics) and provide references for further learning. We will illustrate the basic analysis with examples.

A variable can be thought of as a category of values in a dataset. For example, in a dataset containing age, height and weight of 1000 individuals, weight is a variable and height is another variable. In the univariate analysis, we consider one variable at a time. If we consider two at a time, it is bivariate analysis, and in case of three or more variables, it is termed as multivariate analysis.

2 Univariate data analysis

Univariate analysis is the simplest form of analysing data. The main purpose is to describe, summarize and find patterns in the variable.

We use R, an integrated suite of software facilities for data manipulation, calculation and graphical display (https://www.r-project.org/). There is strong community adding functionalities to R packages or adding more. To begin with, the reader may start with the following articles.

1. https://cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf
2. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf

R is basically command driven but there are many graphical user interface such as `rstudio` or `R-commander`. In the rest of the section we show how to carry out univariate analysis using R. The data structures of R are scalar, vector, matrix, data frame and lists. For in the following a,b and c are scalars and d is data frame.

```
> a=c(2,3,5,6,8)
> b=c(4,4,2,5,6)
> c=c(5,2,6,7,1)
> d=data.frame(a,b,c)
> d
```

[10] Dr. K. Satheesh Kumar, Dept. of Future Studies, University of Kerala

```
a b c
1 2 4 5
2 3 4 2
3 5 2 6
4 6 5 7
5 8 6 1
> d$b
[1] 4 4 2 5 6
>
```

The second column of the data frame `d` can be extracted by `d$b`. If you save the above data as CSV (comma separated values) file, which you do in EXCEL and name it as `abc.csv`, then you can load the data into R with following command where `>` the R command prompt.

```
> d <- read.csv(file="abc.csv")
```

To illustrate univariate statistical analysis we will use an artificial data set using `rnorm(1000)` which will produce 1000 standard normally distributed random numbers.

```
> x = rnorm(1000)
```

To plot the histogram type

```
> hist(x)
```

The bar width can be adjusted by `hist(x,breaks=10)`. The smooth curve approximating histogram can be achieved by

```
> lines(density(x))
```

In addition to measures of central tendency we can also calculate statistics regarding position within distribution. For example the n^{th} quantile is the value such that $n\%$ of the data lie below that value. The quantile positions can be plot into histogram by

```
> lines(density(x))
> abline(v=quantile(x),col="red")
```

The box plot or box and whisker plot displaying distribution of the data based on minimum, first quartile, median third quartile and maximum.

```
> boxplot(x)
```

The empirical cumulative distribution function can be plotted using

```
> plot(ecdf(x))
```

The mean and mdian of `x` can be obtained by

```
> mean(x)
> median(x)
```

However `summary(x)` returns mean, median, quartiles *etc.* The access how the data is spread with respect to the central values we calculate variance (`var(x)`), standard deviation (`sd(x)`), range (`range(x)`) and interquartile range, the difference between first and third quartile (`IQR(x)`).

We can compare empirical distributions of two variables using `qqplot()`. If `x=rnorm(1000)` and `y=x^3` then it is clear the distributions of `x` and `y` are not similar and it can be visualized by

```
> x=rnorm(1000)
> y=x^3
> qqplot(x,y)
> abline(a=0,b=1)
```

where `abline()` draws a line $y = x$. In the following case the distributions of `x` and `y` are similar.

```
> x=rnorm(1000)
> y=rnorm(1000)
> qqplot(x,y)
> abline(a=0,b=1)
```

3 Bivariate data analysis

The first step one do to check the relationship between two variables `x` and `y` is to plot the data using `plot(y~x)` as in the following example.

```
> x = rnorm(1000)
> y = rnorm(1000)
> plot(y ~ x)
```

The correlation between `x` and `y` can be obtained by `cor(x,y)`. The Spearman rank correlation coefficient between two variables can be computed using `a` and `b` by `cor(a,b,method="spearman")`. The covariance can be obtained by `cov(x,y)`.

4 Multivariate Data Analysis

The `trees` dataset inbuilt in r contains measurements of girth, height and volume for black cherry trees. The command `head(trees)` will show the first few lines of the data. `plot(trees)` will create a 5×5 array of scatter plots 3 variables.

```
> head(trees)
> plot(trees)
```

The variations of the three variables can be visualised by `boxplot(trees)`. The correlation matrix of the three variables can be obtained by `cor(trees)`

```
> cor(trees)
Girth     Height    Volume
Girth  1.0000000 0.5192801 0.9671194
Height 0.5192801 1.0000000 0.5982497
Volume 0.9671194 0.5982497 1.0000000
>
```

The covariance can be obtained by `cov(trees)`.

5 Hypothesis Testing

Hypothesis testing is a systematic way of testing claims about a group. Suppose that we claim that school children in Kerala play computer games 2 hours a day on an average. How do we test this claim? `Hypothesis testing` or `significance testing` is a systematic method testing such claims or hypotheses. It is a method of testing claims about a parameter in a population, using measured sample data from the population. Here we test a hypothesis by determining the likelihood that a sample statistic could have been selected if the hypothesis regarding the population parameter were true.

Generally, a `null hypothesis` (H_0), stated as the null, is a statement about a population parameter which is *assumed* to be true. It is a statistical hypothesis which states that there is no difference between a parameter and a specific value or no difference between two parameters. In the previous example school children in Kerala is the population and population parameter is the mean

2 hours children play games. This is assumed to be true, and it is the starting point. Our objective is to test if the null hypothesis is likely to be true or not.

An `alternative hypothesis` (H_1) is a statement that directly contradicts a null hypothesis by stating that the actual value of a population parameter is not equal to the value stated in the null hypothesis. That is, there is a difference between a parameter and a specific value, or states that there is a difference between two parameters.

The criterion of judgement on the hypothesis is referred to as `Level of significance`, or `significance level`. It is based on the probability of obtaining a statistic measured in a sample if the value stated in the null hypothesis were true. The level of significance is typically set at 5% but depends on the situation. We reject the value stated in the null hypothesis if the probability of obtaining a sample mean is less than 5%. Tests can be classified into two-tailed ($H_0 : \mu = k$; $H_1 : \mu \neq k$), right-tailed ($H_0 : \mu = k$; $H_1 : \mu > k$) and left-tailed ($H_0 : \mu = k$; $H_1 : \mu < k$) tests. for example if a researcher thinks that daily consumption of health drinks will increase percentage marks of school children. The average percentage is 67. Then $H_0 : \mu = 67$; $H_1 : \mu > 67$.

A hypothesis is accepted or rejected based on the value of a test statistic given by

$$\text{Test statistic} = \frac{|\text{obeserved value} - \text{expected value}|}{\text{standard error}} \tag{1}$$

When we make a conclusion based on a statistical test, there can be two types of errors called Type I and Type II errors. Type I error is to reject H_0 when H_0 is true, and Type II error is not to reject H_0 when it false. `Significant level` is the maximum probability of committing Type I error. `Critical regon` is the range of values of the test statistic that indicates a significant difference so that the null hypothesis is rejected. `Non-critical region` is the range of values for the test value that indicates that the difference is probably due to chance so that the null hypothesis is rejected. `Critical value` separates these two regions. Testing a hypothesis has four steps. The first is to state the hypothesis. The second is to find the critical value. The next is to compute the test statistic value, and then the fourth is to make a decision based on the test statistic value. In what follows we illustrate the concept with few different type of tests and problem solving using R.

5.1 z-test

A z-test is used for testing the mean of a population versus a standard, or comparing the means of two populations, with large ($n \geq 30$) samples whether you know the population standard deviation. It is also used for testing the proportion of some characteristic versus a standard proportion or comparing the proportions of two populations.
Example: Comparing the percentage of marks of girls and boys.
Example: Comparing the fraction defectives from 2 production lines.

The z test is a statistical test for the mean of a population. It can be used when $n \geq 30$, or when the population is normally distributed and σ is known. The formula for the z test is

$$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \tag{2}$$

where
X = sample mean
μ = hypothesized population mean
σ = population standard deviation
n = sample size

In Eq.2, mean of the sample $\bar{X}$ is the observed value, population mean μ is the expected value and the denominator $\sigma/\sqrt{n}$ is the standard error.

Problem: Suppose that ten volunteers have done an intelligence test; here are the results obtained. The mean obtained at the same test, from the entire population is 75. You want to check if there is a statistically significant difference (with a significance level of 95%) between the means of the sample and the population, assuming that the sample variance is known and equal to 18. 65, 78, 88, 55, 48, 95, 66, 57, 79, 81

Solution:

```
> z.test = function(a, mu, var){     zeta = (mean(a) - mu) / (sqrt(var / length(a)))
return(zeta)} # using the formula of z above
> a = c(65, 78, 88, 55, 48, 95, 66, 57, 79, 81)
> z = z.test(a, 75, 18)
> 2*pnorm(-abs(z))     # (two sided)
```

The p-value given by above code is 0.004621447. Since p-values is less than 005, we reject the null hypothesis that there is no difference. That is, we conclude that the mean of our sample is significantly differ

5.2 t-test

A t-test is used for testing the mean of one population or comparing the means of two populations when the standard deviation of teh population is unknown and sample size is limited ($n < 30$). If you know the population' standard deviation, you may use a z-test. The t-distribution assume a simple random sample, $X_1, X_2, \ldots, X_n$, of size n is drawn from a normal population. Since we do not know σ, we estimate it by the sample standard deviation, S. We then replace the standard deviation, $n/\sqrt{n}$, of X by its standard error $S/\sqrt{n}$. The resulting one sample statistics,

$$T = \frac{\bar{X} - \mu}{\frac{S}{\sqrt{n}}} \tag{3}$$

has the t-distribution with $n1$ degrees of freedom. The tails of the t distribution are heavier than those of the Normal distribution. It may be noted that if the sample size is large, the distribution of t is approximately standard normal.

5.2.1 One-sample t-test

A one-sample t-test is used to compare the mean value of a sample with a constant value denoted μ. The test has the null hypothesis that the population mean is equal to μ and the alternative hypothesis that it is not equal to μ. The test can also be performed with a one-sided alternative hypothesis, which is known as a one-tailed test. The one-sided alternative hypothesis is either than the population mean is less than μ or that the population mean is greater than μ.

Problem: The manager of a drinking water company producing 500 ml water bottles believes the machine is under-filling bottles. The sample of 20 bottles he picked up has volume measured of water as given below. Volume: 485.03, 473.88, 501.59, 502.85, 538.08, 484.11, 459.49, 471.38, 512.01, 494.48, 475.32, 529.41, 518.13, 464.32, 449.08, 489.27, 528.63, 493.64, 465.68, 495.03

Test the null hypothesis that the mean filling volume is equal to 500 ml and the alternative hypothesis that the mean filling volume is less than 500 ml with the significance level of 0.01.

Solution: We solve the problem using R.

```
> volume = c(484.87, 473.88,501.59, 502.85, 537.2,484.11, 478,
471.38, 512.01, 494.48, 475.32,529.41,518.13, 464.32,449.08,
489.27,529.5, 494.01, 465.68,498.02)
> mean(volume)
```

Output:
[1] 492.6555

He wants to test if the bottles are being consistently underfilled, or whether the low mean volume for the sample is purely the result of random variation. A one-sided test is suitable because the manager is specifically interested in knowing whether the volume is less than 500 ml. The test has the null hypothesis that the mean filling volume is equal to 500 ml, and the alternative hypothesis that the mean filling volume is less than 500 ml with the significance level of 0.01.

```
> t.test(volume, mu=500, alternative="less", conf.level=0.99)
```

This gives the following output:

```
One Sample t-test

data:  volume
t = -1.3758, df = 19, p-value = 0.09244
alternative hypothesis: true mean is less than 500
99 percent confidence interval:
-Inf 506.2119
sample estimates:
mean of x
492.6555
>
```

The mean bottle volume for the sample is 491.6 ml. The p-value of 0.09244 corresponding to the critical value is not less than 0.01 we can not reject the null hypothesis that the mean filling volume is equal to 500 ml. So the mean filling volume is likely to be less than 505.6 ml.

5.3 Two-sample t-tests

Here we compare the means of two samples.

Problem: Seven students were given health drink A and an additional seven students were not given health drink A for a period of one year. Their final exam marks in percentage given below. We want to perform a two-sample t-test for comparing the means of marks of the two groups.

nodrink: 89, 85, 99, 77, 85, 91,78
drink: 97,98, 97, 93, 99, 98,96

Solution: Let μ_1 be the mean of the population consuming the drink and μ_2 the mean of the population having no health drink. Here the hypothesis of interest can be expressed as:

$$H_0 : \mu_1 - \mu_2 = 0 \tag{4}$$
$$H_a : \mu_1 - \mu_2 < 0 \tag{5}$$
$$\tag{6}$$

Here we will need to include the data for the treatment group in x and the data for the group without taking the drink in y. We will also need to include the options `alternative="less", mu=0`. Finally, we need to decide whether or not the standard deviations are the same in both groups. Below is the relevant R-code when assuming equal standard deviation:

```
> nodrink = c(89, 85, 99, 77, 85, 91,78)
> drink = c(97,98, 97, 93, 99, 98,96)
> t.test(nodrink,drink,alternative="less", var.equal=TRUE)
```

Output:

```
Two Sample t-test

data:  nodrink and drink
t = -3.5508, df = 12, p-value = 0.001996
alternative hypothesis: true difference in means is less than 0
```

```
95 percent confidence interval:
-Inf -5.265134
sample estimates:
mean of x mean of y
86.28571  96.85714
>
```

The R-code for the assumption that standard deviations are not equal:

```
>  t.test(nodrink,drink,alternative="less")

Welch Two Sample t-test

data:  nodrink and drink
t = -3.5508, df = 6.7816, p-value = 0.004918
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
-Inf -4.903369
sample estimates:
mean of x mean of y
86.28571  96.85714

>
```

Here the pooled t-test and the Welsh t-test give roughly the same results (p-value = 0.001996 and 0.004918 , respectively).

5.4 Paired t-tests

In a matched pairs design, subjects are matched in pairs for different treatments. There are many experimental settings where each subject in the study is in both the treatment and control group. In this case, a pair of subjects are identified and treated with different treatments, and hence there are compared pair-wise. In another case, we can consider a subject before and after treatment. In these situations, we cant use two-sample t-tests since the independence assumption is not valid and we have to use a paired t-test. This can be done using the option `paired = TRUE`.

Problem: A study was conducted to check if speed petrol gives more mileage than regular petrol.Out of the ten cars selected, each one was first filled with regular petrol and then speed petrol and mileage was recorded. We use a paired t-test to determine whether cars get significantly better mileage with speed petrol. The data are given by:

regular: 17, 20, 22, 21, 23, 22, 27, 25, 27, 29
speed: 18, 22, 25, 24, 25, 25, 26, 26, 28, 33

Solution: Below is the relevant R-code:

```
> regular=c(17, 20, 22, 21, 23, 22, 27, 25, 27, 29)
> speed=c(18, 22, 25, 24, 25, 25, 26, 26, 28, 33)
> t.test(speed,regular,alternative="greater", paired=TRUE)

Paired t-test

data:  speed and regular
t = 4.1461, df = 9, p-value = 0.001249
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
```

```
1.059962      Inf
sample estimates:
mean of the differences
1.9

>
```

The results show that the t-statistic is equal to 4.1461 and the p-value is 0.001249. Since the p-value is very low, we reject the null hypothesis. There is strong evidence of a mean increase in mileage between regular and speed petrol.

5.5 Chi-Square Test

The chi-square test of independence is used to whether there is a significant association between the categories of the two variables. Here we illustrate of chi-square test by practical examples using R software.

The inbult data `survey` in R provides smoking habits of 237 subjects. `Excer` column of the data records their level of exercise and `Smoke` column gives the smoking habit. We create a contingency table ffrom the data.

```
> library(MASS)       # load the MASS package
> tbl = table(survey$Smoke, survey$Exer)
> tbl                 # the contingency table

Freq None Some
Heavy    7    1    3
Never   87   18   84
Occas   12    3    4
Regul    9    1    7
```

Here the column names Freq, None Some means frequently, never and some respectively. The problem is to test the hypothesis that the smoking habit is independent of their exercise level. We conduct chi-square test as follows:

```
> chisq.test(tbl)

Pearsons Chi-squared test

data:  table(survey$Smoke, survey$Exer)
X-squared = 5.4885, df = 6, p-value = 0.4828

Warning message:
In chisq.test(table(survey$Smoke, survey$Exer)) :
Chi-squared approximation may be incorrect
```

since the p-value 0.4828 is not less than 0.05 we can not reject the null hypothesis that they are independent. Since there warning at end of the output due small cell values we combine second and third column together and test again.

```
> ctbl = cbind(tbl[,"Freq"], tbl[,"None"] + tbl[,"Some"])
> ctbl
[,1] [,2]
Heavy    7    4
Never   87  102
Occas   12    7
Regul    9    8
```

```
> chisq.test(ctbl)

Pearsons Chi-squared test

data:  ctbl
X-squared = 3.2328, df = 3, p-value = 0.3571
```

Here again p-value is not less than 0.05.

5.6 F-test

F-test is used to assess whether the variances of two populations (A and B) are equal. An F-test is used to compare two populations' variances. The samples can be any size. It is the basis of ANOVA, analysis of variance. Comparing two variances is useful in several cases. For example, to check the equality of the variances of the two samples when we want to perform a two samples t-test. Another case is to compare the variability of a new measurement method to an old one. One may want to check a new method reduces the variability of the measurements.
Example: The inbuilt data `ToothGrowth` gives the effect of Vitamin C on Tooth Growth in Guinea Pigs. We want to check equality of variances between the groups OJ and VC in column `supp`. The normality of the data can be checked using Q-Q plot. The F-test can be conducted as follows:

```
> var.test(len ~ supp, data = my_data)

F test to compare two variances
data:  len by supp
F = 0.6386, num df = 29, denom df = 29, p-value = 0.2331
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.3039488 1.3416857
sample estimates:
ratio of variances
0.6385951
```

Since the p-value is 0.2331433 which is greater than 0.05 we can not reject the null hypothesis that there is difference in variances with 95% confidence level.

5.7 ANOVA

The one-way analysis of variance (ANOVA) or one-factor ANOVA can be seen as an extension of independent two sample t-test for comparing means of more than two groups. The null hypothesis is that there is no significant difference in the means of different groups and the alternative hypothesis is that at least mean of one group is not equal to that of others. Consider the inbuilt data PlantGrowth containing weights if plants treated with treatments `trt1`, `trt2` and the control group `ctrl`.

```
> trt1=PlantGrowth[which(PlantGrowth$group=="trt1"),1]
> trt2=PlantGrowth[which(PlantGrowth$group=="trt2"),1]
> ctrl=PlantGrowth[which(PlantGrowth$group=="ctrl"),1]
> pg=data.frame(ctrl,trt1,trt2)
> boxplot(pg)
```

The boxplot will give an idea about the variations in the data. The oneway ANOVA can be carried out in R as follows:

```
> # Compute the analysis of variance
> res.aov <- aov(weight ~ group, data = my_data)
> # Summary of the analysis
```

```
> summary(res.aov)
Df Sum Sq Mean Sq F value Pr(>F)
group        2  3.766  1.8832   4.846 0.0159 *
Residuals   27 10.492  0.3886
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1
```

since the p-value 0.0159 is less than 0.05 we can not reject the null hypothesis that there is no difference between groups with 95% confidence level.

In case more than one dependent variables we use multivariate analysis of variance (MANOVA)

6 Regression

Regression analysis is referred to the statistical process of estimating relationships among variables. Generally the relationship of the outcome or dependent variable on the independent variable. It is widely used for prediction. In restricted circumstances, regression analysis can be used to infer causal relationship but caution must be taken as correlation does not imply causation in general.

If there is more than one dependent (outcome) variable, you can test them simultaneously using a multivariate analysis of variance (MANOVA).

A simple linear regression model that describes the relationship between two variables x and y can be expressed by the following equation where m and c are called parameters, and ϵ is the error term.

$$y = mx + c + \epsilon \tag{7}$$

We want to find the values of m and c in the simple linear regression model so that the sum of squares of the error term ϵ is minimum. It allows us to compute fitted values of y based on values of x. The inbuilt data `faithful`, old faithful geyser data, contains values of `eruptions` and `waiting`. We would like to find the relation between them as given by

$$eruptions = m * waiting + c + \epsilon \tag{8}$$

If we choose the parameters m and c in the simple linear regression model so as to minimize the sum of squares of the error term ϵ, we will have the so-called estimated simple regression equation. It allows us to compute fitted values of y based on values of x. We would like to estimate the next eruption if the waiting time since last eruption is 50 minutes.

```
> head(faithful)
>  cor(faithful$waiting,faithful$eruptions)
[1] 0.9008112
>  model = lm(eruptions ~ waiting, data=faithful)
>
>  coeffs = coefficients(model); coeffs
(Intercept)     waiting
-1.87401599  0.07562795
# toplot the regession line
> plot(faithful$waiting,faithful$eruptions)
> abline(model)
```

Suppose the waiting time is 50 minutes the would like to estimate the eruption.

```
> waiting = 80
> duration = coeffs[1] + coeffs[2]*waiting
> duration
(Intercept)
1.907381
>
```

Therefore, the model predicts the erruption to be 1.907381.

The main objective this introductory article is to motivate the beginner to start using R, a free software environment for statistical computing and graphics. For most of the analysis one can find a solution online. The computers in the campus computing facility (CCF) at the university campus are installed with R package for analysis. Here we list few resources and books for further information.

1. Gonick, Larry, and Woollcott Smith. The cartoon guide to statistics. (1993).
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3. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.
4. Armstrong, J. Scott. Illusions in regression analysis. (2011).
5. A. Gelman and J. Hill. Data analysis using regression and multilevel/hierarchical models. Cambridge University Press, Cambridge, UK, 2007.
6. D. S. Moore, G. P. McCabe, and Craig B. S. Introduction to the Practice of Statistics. W. H. Freeman, 2009.
7. James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013.
8. https://www.r-project.org/
9. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
10. https://cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf
11. https://www.r-bloggers.com/

D8. സാഹിത്യ ഗവേഷണം - ഭൂമിക [11]

സർവകലാശാലകളുടെ പ്രഖ്യാതമായ ദൗത്യങ്ങൾ രണ്ടാണ്. വിജ്ഞാന വിതരണവും വിജ്ഞാന നിർമ്മിതിയും. ബിരുദതലത്തിലും ബിരുദാനന്തര തലത്തിലും നമ്മുടെ സർവകലാശാലകളിൽ മുഖ്യമായും നടക്കുന്നത് വിജ്ഞാന വിതരണമാണ്. ഒരു പ്രത്യേക വിദ്യാവിഭാഗത്തിലെ അംഗീകൃതമായ ആശയങ്ങളും നിരീക്ഷണങ്ങളും വിദ്യാർത്ഥികൾക്ക് അദ്ധ്യാപകൻ പകർന്നു കൊടുക്കുകയോ അവർ ഗ്രന്ഥങ്ങളിൽ നിന്നോ ഇന്റർനെറ്റിൽ നിന്നോ നേരിട്ടു ഗ്രഹിക്കുകയോ ചെയ്യുന്നു. നിശ്ചിതമായ സിലബസ്സിന്റെ പരിധിയിൽ നിന്നുകൊണ്ടാണ് അദ്ധ്യാപകർ പഠിപ്പിക്കുന്നത്. അവർ പൊതുവേ ഗവേഷണ കുതുകികളായിരിക്കുകയുമില്ല. സ്ഥാപിതമായ അറിവിന്റെ പരിധി വിട്ടുപോകുന്ന ആശയങ്ങളോട് പരീക്ഷകർ അസഹിഷ്ണുക്കളായിരിക്കുകയും ചെയ്യും. അതുകൊണ്ടുതന്നെ ഈ തലങ്ങളിൽ വിജ്ഞാന വിതരണമല്ലാതെ വിജ്ഞാന നിർമ്മിതി കാര്യമായി നടക്കുന്നില്ല. വിജ്ഞാന നിർമ്മിതിയുടെ മാർഗ്ഗമാണ് ഗവേഷണം. വളരെ ചെറിയൊരളവോളം അതിനുള്ള സാദ്ധ്യത, എം.ഫിൽ പഠന തലത്തിലുണ്ട്. എന്നാൽ പി.എച്ച്.ഡി. ഗവേഷണത്തിന്റെ അടിസ്ഥാന ലക്ഷ്യംതന്നെ വിജ്ഞാന നിർമ്മിതിയാണ്. നിലവിലുള്ള വിജ്ഞാനത്തിന്റെ പരിധി ഒട്ടെങ്കിലും വികസിപ്പിക്കാൻ കഴിയുമ്പോഴാണ് പി.എച്ച്.ഡി തലത്തിലുള്ള ഗവേഷണം സഫലമാകുന്നത്.

ഗവേഷണം എന്ന വാക്ക് ഇംഗ്ലീഷിലെ Researchനു തുല്യമായാണ് പ്രയോഗിച്ചു പോരുന്നത്. റിസർച്ച് എന്ന ഇംഗ്ലീഷ് വാക്കിന്റെ അർത്ഥം പുനരന്വേഷണം എന്നാണ്. ഏതു വിഷയത്തെക്കുറിച്ചും കുറച്ചെങ്കിലും അന്വേഷണങ്ങൾ നടന്നിട്ടുണ്ടാവും. അതിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ടുള്ള തുടരന്വേഷണമാണ്, ഗവേഷണം. ഡോ. പി.വി. വേലായുധൻപിള്ള പറയുന്നു "പൂർവ്വജ്ഞാതമായ അറിവുകളുടെ മേൽ സ്വകീയമായ അന്വേഷണ വിചന്തനങ്ങളുടെ ഫലമായി രൂപപ്പെടുന്ന അഭിപ്രായങ്ങളെ സോദ്ദേശ്യമായി അടുക്കിവച്ച് നിഗമനങ്ങളിൽ എത്തുന്ന സമ്പ്രദായം കൂടിയാണിത്."[1] ഈ അന്വേഷണം സ്ഥാപിതമായ അറിവിനെ അപ്പാടെ അംഗീകരിച്ചെന്നു വരില്ല. അതിനെ ചോദ്യം ചെയ്യുകയോ തിരുത്തുകയോ ചെയ്യും. പക്ഷേ അപ്പോഴൊന്നും ഗവേഷകൻ അതിനെ നിന്ദിക്കുകയോ പരിഹസിക്കുകയോ ചെയ്യുന്നില്ല. താൻ അവതരിപ്പിക്കുന്ന പുതിയ വിജ്ഞാനം എക്കാലത്തും സാധുവായിരിക്കുമെന്ന് ഭാവിക്കുന്നുമില്ല. അതിന് കഴിയുന്നത്ര വസ്തുനിഷ്ഠമായ

[11] Prof. D. Benjamin, Retd. Professor of Malayalam, University of Kerala

തെളിവുകളുടെ, യുക്തികളുടെ പിൻബലം നൽകുക മാത്രമേ ചെയ്യുന്നുള്ളൂ. അത്രത്തോളം വിശ്വാസ്യതയും ഭദ്രതയും അയാൾ അവകാശപ്പെടുന്നുണ്ടുതാനും.

സാഹിത്യ ഗവേഷണത്തെ നിർവചിക്കാനുള്ള കാര്യമായ ശ്രമങ്ങൾ നടന്നിട്ടില്ല. സാഹിത്യമുൾപ്പെടെയുള്ള മാനവിക വിഷയങ്ങളിലെ ഗവേഷണത്തിനു നൽകപ്പെട്ടിട്ടുള്ള നിർവചനമാണ് പലപ്പോഴും സാഹിത്യഗവേഷണത്തിനും ബാധകമാക്കാറുള്ളത്. ഇത് സാഹിത്യ ഗവേഷണത്തിന്റെ അനന്യതയെ അവഗണിക്കുന്നു. വിദ്യാഭ്യാസത്തിലും ചരിത്രത്തിലും സാമൂഹിക ശാസ്ത്രത്തിലും ധനതത്ത്വ ശാസ്ത്രത്തിലുമൊക്കെ ഗവേഷണത്തിന് ഇന്ന് ഏതാണ്ട് യാന്ത്രികമായിത്തീർന്ന, ഘനീഭവിച്ച ഒരു ചട്ടക്കൂടുണ്ട്.[2] പ്രശ്നമെന്തായാലും ഗവേഷണ പ്രബന്ധത്തിന്റെ ഘടന എന്താവുമെന്ന് മുൻകൂട്ടി പറയാവുന്ന ഈ യാന്ത്രികമായ ഇടുങ്ങിയ ഘടനയിൽ സാഹിത്യ ഗവേഷണത്തെ ഞെരുക്കിയൊതുക്കാൻ കഴിയുകയില്ല. ശാസ്ത്ര രംഗത്തെ ഗവേഷണ പദ്ധതിയുമായി സാഹിത്യ ഗവേഷണത്തിനു വളരെ അകന്ന ചാർച്ചയേയുള്ളൂ. എങ്കിലും ഗവേഷണത്തെക്കുറിച്ച് പൊതുവായി അംഗീകരിക്കാവുന്ന വളരെ ലളിതവും ഋജുവുമായ ഒരു സമവാക്യമുണ്ട്. 'ശാസ്ത്രീയവും ക്രമബദ്ധവുമായ അന്വേഷണമാണ് ഗവേഷണം.' ശാസ്ത്രീയമെന്നു പറയുമ്പോൾ, പ്രധാനമായും ഉദ്ദേശിക്കുന്നത് വസ്തുനിഷ്ഠതയാണ്. ക്രമബദ്ധതയെന്നു പറയുമ്പോൾ ചിട്ടയോടു കൂടിയത് എന്നും. എന്നാൽ പരീക്ഷണശാലയിലെ പരീക്ഷണ നിരീക്ഷണങ്ങളിലൂടെ നടത്തുന്ന ഭൗതിക ശാസ്ത്ര ഗവേഷണങ്ങൾക്ക് അവകാശപ്പെടാവുന്ന വസ്തുനിഷ്ഠത, സാഹിത്യ ഗവേഷണത്തിനുണ്ടാകുമെന്ന് കരുതുക വയ്യ. ഗവേഷകന്റെ അഭിരുചിയുടേയോ (Sensibility) ആത്മാംശത്തിന്റെയോ നേരിയ ഛായ പ്രബന്ധത്തിൽ കലർന്നെന്നും വരും. ഒരേ സാഹിത്യ പ്രശ്നം രണ്ടുപേർ കൈകാര്യം ചെയ്യുമ്പോൾ കൃത്യമായും ഒരേ തീസിസിൽത്തന്നെ എത്തിച്ചേരുമെന്നു പറയാൻ കഴിയുകയില്ലെന്നു തീർച്ച. രണ്ടുപേരും കണ്ടെത്താനിടയുള്ള ദത്ത (Data) ങ്ങളുടെ ഏറ്റക്കുറച്ചിൽ മാത്രമല്ല അവരുടെ അഭിരുചി ഭേദവും ഇതിനു കാരണമാണ്. അതുകൊണ്ട് ഭാഷാ ഗവേഷണമല്ലാതെ സാഹിത്യ ഗവേഷണം സാദ്ധ്യമാകുമോ എന്ന് ചില പണ്ഡിതന്മാർ സംശയിച്ചിട്ടുണ്ട്. വസ്തുനിഷ്ഠതയ്ക്കും ക്രമബദ്ധതയ്ക്കും ആപേക്ഷികമായ അർത്ഥമാണ് ഇവിടെയുള്ളതെന്ന് മനസ്സിലാക്കിയാൽ പ്രശ്നം തീർന്നു.

ഏതു തലത്തിൽ വച്ചാണ് സാഹിത്യ വിമർശനവും സാഹിത്യ ഗവേഷണവും തമ്മിൽ വേർപിരിയുന്നത്? ഇങ്ങനെയൊരു ചോദ്യം ഇവിടെ പ്രസക്തമാണ്. (സാഹിത്യ വിമർശനം എന്ന സംജ്ഞ ഇവിടെ ഇംഗ്ലീഷിലെ ഡിസ്കൃപ്റ്റീവ് ക്രിട്ടിസിസം എന്ന അർത്ഥത്തിലാണ് പ്രയോഗിച്ചിരിക്കുന്നത്.) വിമർശനം പാണ്ഡിത്യത്തോടെന്നതിനെക്കാൾ വിമർശകന്റെ അഭിരുചിയോടും ഭാവുകത്വത്തോടും ബന്ധപ്പെട്ടിരിക്കുന്നു. ഏറ്റവും ലോലമായ സൗന്ദര്യ ഛായയോടുപോലും പ്രതികരിക്കാനുള്ള സിദ്ധിയാണ്, വിമർശകന്റെ കൈമുതൽ എന്നും അയാൾക്കു പാണ്ഡിത്യമോ ശിക്ഷണമോ ആവ

ശ്യമില്ലെന്നും വാൾട്ടർ പേറ്ററിനെപ്പോലുള്ളവർ വാദിച്ചിട്ടുള്ളത് ഇവിടെ ഓർക്കുക.[3] സാഹിത്യ നിരൂപണം സ്യൂഡോ സ്റ്റേയ്റ്റ്മെന്റാണെന്നും അതിന്റെ നിഗമനങ്ങൾ പരിശോധിച്ച് സാധുത്വം തെളിയിക്കാനാവാ (verifiable) ത്തതാണെന്നും അക്കാദമീയ വിമർശനത്തെക്കുറിച്ചുള്ള ചർച്ചയ്ക്കിടയിൽ നോർത്രോപ് ഫ്രൈ[4] നിരീക്ഷിക്കുന്നുണ്ട്. വിമർശനമെന്ന സംജ്ഞ പലതരം സമീപനങ്ങൾ ഉൾക്കൊള്ളുന്നു. ഒരു കൃതി അനുവാചകന്റെ ഹൃദയത്തിലുളവാക്കുന്ന അനുഭൂതിയുടെ കേവല പുനരാവിഷ്കാരം വിമർശനമാകും. അനുഭൂതിക്കു നിദാനമായി സാഹിത്യ കൃതികളിലുള്ള വ്യത്യസ്ത ഘടകങ്ങളുടെ അപഗ്രഥനത്തിലാണ് മറ്റു ചിലർ ഊന്നുന്നത്.• ചിലരുടെയെങ്കിലും വാദമനുസരിച്ച് സാഹിത്യകൃതിയുടെ മൂല്യ നിർണ്ണയനം നടക്കുമ്പോഴേ സാഹിത്യ വിമർശനമാകൂ.

വിമർശകൻ തന്റെ നിരീക്ഷണങ്ങളും വെളിപാടുകളും യുക്തികളുടെയും തെളിവുകളുടെയും അടിസ്ഥാനത്തിൽ വാദിച്ചു സ്ഥാപിച്ചേതീരൂ എന്നില്ല.

സമകാലവിമർശകനാവട്ടെ വ്യക്തമായ ചില ആശയാവലികളുടെ അടിസ്ഥാനത്തിൽ കൃതികളെ അപഗ്രഥിച്ച് നിഗമനങ്ങളിലെത്തിച്ചേരുമ്പോഴും മൂല്യ നിർദ്ധാരണം ഒഴിവാക്കുന്നു.

സാഹിത്യകൃതി സൃഷ്ടിക്കുന്ന വൈകാരികവും ഭാവനാത്മകവുമായ പ്രതീതി പുനരാവിഷ്കരിക്കുന്നതിൽ ചരിതാർത്ഥനാകുന്ന കെ.പി. ശങ്കരനും കൃതിയെ കർക്കശമായ യുക്തി ചിന്തയ്ക്കു വിധേയമാക്കുന്ന കുട്ടികൃഷ്ണമാരാരും മൂല്യ നിർദ്ധാരണത്തിൽ ഊന്നുന്ന മുണ്ടശ്ശേരിയും എഴുതുന്നത് വിമർശനം തന്നെ. ധാരാളം പാശ്ചാത്യ ചിന്തകരുടെ ആശയങ്ങളെ ഉപജീവിക്കുമ്പോഴും ആകരങ്ങളെക്കുറിച്ച് സൂചന നൽകുന്നില്ല എന്നതിന്റെ പേരിൽ ആരും കെ.പി. അപ്പനെ കുറ്റപ്പെടുത്തിയിട്ടില്ല. വിമർശനത്തെ സംബന്ധിച്ചിടത്തോളം അതെടുത്തു പറയേണ്ട പരിമിതിയല്ല. എന്നാൽ ഗവേഷണ ലക്ഷ്യം പാണ്ഡിത്യം നേടലാണ്. ഗവേഷകനുണ്ടാകേണ്ട പ്രധാന സിദ്ധികളിലൊന്നും പാണ്ഡിത്യമാണ്. ആത്മ പ്രതികരണങ്ങൾക്കും വ്യക്തിപരമായ ഇഷ്ടാനിഷ്ടങ്ങൾക്കും അവിടെ പ്രസക്തി കുറയും. ഉള്ളൂരിന്റെ കവിതതന്റെ അഭിരുചിക്കിണങ്ങാത്തതുകൊണ്ട് അദ്ദേഹത്തിന്റെ കവിതയ്ക്ക് ഒരു പ്രസക്തിയുമില്ല എന്നു പറയാൻ ഗവേഷകന് അവകാശമില്ല. 'വാഴക്കുല' തന്നെ ഹഠാദാകർഷിച്ചതുകൊണ്ട് അത് മലയാളത്തിലെ മികച്ച ക്ലാസിക്കാണെന്നു പറയാനും കഴിയില്ല. ഗവേഷണ വിഷയത്തിൽ നിന്ന് ഒട്ടൊരു നിർലേപതയോടെ നിശ്ചിത അകലം പാലിച്ചു നിൽക്കുക. ആത്മാംശം പരമാവധി ഒഴിവാക്കുക.[5] ദത്തങ്ങളോട് വിട്ടുവീഴ്ചയില്ലാത്ത സത്യസന്ധത പുലർത്തുക. ദത്തങ്ങളുടെ അപഗ്രഥനം ആസ്പദമാക്കി നിഗമനങ്ങളിലെത്തിച്ചേരുക. ഏതു നിഗമനത്തെയും യുക്തികളും തെളിവുകളും ഉന്നയിച്ച് സമർത്ഥിക്കുക. വസ്തുതകളുടെയും യുക്തികളുടെയും പിൻബലമില്ലാത്ത ഏതു വെളിപാടും അതെത്ര പ്രിയപ്പെട്ടതായാലും ഒഴിവാക്കുക. ഈ തത്ത്വങ്ങളിലധിഷ്ഠിതമായ ഒരു രീതിശാസ്ത്രം പിന്തുടരാൻ ഗവേഷകൻ ബാദ്ധ്യസ്ഥനാണ്.

ഇതിന്റെയർത്ഥം ഗവേഷണത്തിനും വിമർശനത്തിനുമിടയിൽ മറികടക്കാനാവാത്ത ബലിഷ്ഠമായ ഒരു ഇരുമ്പു കോട്ടയുണ്ടെന്നല്ല. ഏതു വിമർശന പദ്ധതിയുടെ ഉപകരണവും ആശയാവലിയും ദത്തങ്ങളുടെ അപഗ്രന്ഥത്തിനു ഉപയോഗപ്പെടുത്താം. സമീപനത്തിൽ വസ്തുനിഷ്ഠതയും ചിട്ടയും പാലിക്കണമെന്നേയുള്ളൂ. അതുകൊണ്ടാണ് ഗവേഷണത്തിന്റെ കുലപതിയായ ഡോ. പി.കെ. നാരായണപിള്ള സാഹിത്യഗവേഷണത്തെ ഇങ്ങനെ നിർവചിച്ചത്. "ആസ്വാദനവും വിമർശനവും അന്തർഭവിക്കുന്നതും അതേസമയം ശാസ്ത്രീയ തത്ത്വങ്ങളെ ആസ്പദിച്ചതും കൂടുതൽ ധൈഷണികവും ആയാസകരവുമായ ഒരു സാരസ്വതയത്നമാണ് സാഹിത്യഗവേഷണം."[6] എങ്കിലും ആസ്വാദനത്തെ സാഹിതീയ പ്രശ്നത്തിലേയ്ക്കു കടക്കാനുള്ള ആരംഭബിന്ദുവായിമാത്രമേ കരുതേണ്ടതുള്ളൂ. ഗവേഷണ പ്രബന്ധത്തിൽ ആസ്വാദനത്തിന് അതിന്റെ തനിമയിൽ പ്രസക്തി നന്നേ കുറയും. സാഹിത്യാനുഭവത്തെ ബൗദ്ധികമായ ഭാഷയിലേയ്ക്കു വിവർത്തനം ചെയ്യാനും യുക്തിപരമായ ഘടന നൽകാനും കഴിഞ്ഞാലേ അത് 'ജ്ഞാന'മാവുകയുള്ളൂ എന്ന റെനെ വെല്ലക്കിന്റെയും ഓസ്റ്റിൻവാരന്റെയും വാദം ഓർക്കുക.[7]

ഡോ. കെ. രാമചന്ദ്രൻ നായർ മലയാള വിമർശനത്തിന്റെ പരാധീനതയായി ചൂണ്ടിക്കാണിക്കുന്നത് ഗവേഷണ പ്രബന്ധങ്ങളിൽ കാണുന്ന വിമർശനത്തിന്റെ കലർപ്പാണ്." നമ്മുടെ പി.എച്ച്.ഡി. പ്രബന്ധങ്ങൾ കുറച്ച് ഗവേഷണവും കുറച്ചു നിരൂപണവും തമ്മിൽ കലർത്തിയ ഒരു വിചിത്രമിശ്രിതമായി പ്രത്യക്ഷപ്പെടുന്നു. ആ ചേരുവയുടെ അനുപാതക്രമം പ്രതിവ്യക്തി ഭിന്നമായിരിക്കുന്നു."[8] തീർച്ചയായും ഗവേഷണപ്രബന്ധത്തിലെ വിമർശനാംശം ഗവേഷണാംശത്തെ അധക്കരിക്കുന്ന വിധമാവാൻ പാടില്ല. അതേസമയം അതിനെ പാടെ ഒഴിച്ചുനിർത്തുക പ്രായോഗികവുമല്ല. ഏത് സാഹിത്യഗവേഷണത്തിന്റെ കാര്യത്തിലും ഇത് ഒഴിവാക്കാനാവാത്തതായിരിക്കും. ഡോ. പി.വി. വേലായുധൻ പിള്ള വാദിക്കുന്നതു പോലെ "പ്രബന്ധകാരൻ സഹൃദയനായ നിരൂപകൻ കൂടിയായിരിക്കണം. സഹൃദയനായ നിരൂപകന് പാണ്ഡിത്യം കൂടി വേണമെന്നുള്ളത് പ്രസിദ്ധവുമാണല്ലോ."[9]

സാഹിത്യത്തെ ഒരു സാംസ്കാരികോല്പന്നമായി കാണുന്നതിൽ കുഴപ്പമൊന്നുമില്ല. അതുകൊണ്ട് അത് ഒരു മികച്ച കലാരൂപമല്ലാതാകുന്നില്ല. കർക്കശമായ യുക്തിയുടെ ഭാഷയ്ക്ക് പൂർണ്ണമായും പിടിതരാത്ത ചില ഘടകങ്ങളാണ് അതിനെ കലാരൂപമാക്കി മാറ്റുന്നത്. സാഹിതീയ പ്രശ്നങ്ങളെക്കുറിച്ചുള്ള സൂക്ഷ്മമായ അപഗ്രഥനത്തിന് കേവലമായ യുക്തിയുടെ മാനദണ്ഡങ്ങൾ മാത്രം പര്യാപ്തമാകാതെ പോകുന്നത് അതുകൊണ്ടാണ്. ശാസ്ത്രപഠനവും സാഹിത്യപഠനവും തമ്മിലുള്ള വ്യത്യാസം റെനെവെല്ലക്കും ഓസ്റ്റിൻ വാരനും വിശദമാക്കുന്നത് ശ്രദ്ധിക്കുക "No general law can be assumed to achieve the purpose of literary study: The more general, the more abstract and hence empty it will seem; The more the concrete object of the work of art will elude our grasp."[10] ഈ വ്യത്യാസം

സാഹിത്യഗവേഷണത്തിന് തനതായ ഒരു രീതി ശാസ്ത്രം അനിവാര്യമാക്കുന്നു.

മലയാള ഗവേഷണത്തിന്റെ ചരിത്രത്തിൽ അനൗപചാരിക ഗവേഷണത്തിന്റെ ഒരു ഘട്ടമുണ്ടായിരുന്നു. മികച്ച പണ്ഡിതന്മാരാണ് ഈ മേഖലയെ സമ്പുഷ്ടമാക്കിയത്. പ്രാചീനകൃതികളുടെ കണ്ടെത്തലും അവയുടെ ഭാഷാപരമായ സ്വഭാവം വിശകലനം ചെയ്യലും പാഠസംസ്കരണവും ഒക്കെയാണ് അവർ ചെയ്തിരുന്നത്. തീർച്ചയായും അവരുടെ സംഭാവന വിലപ്പെട്ടതാണ്. അനേകം പ്രാചീനകൃതികൾ കണ്ടെത്താനും മലയാള ഭാഷയുടെയും സാഹിത്യത്തിന്റെയും പ്രാചീന മദ്ധ്യകാലഘട്ടങ്ങളുടെ ചരിത്രത്തിന്റെ രൂപരേഖ തയാറാക്കാനും അവ കുറച്ചൊന്നുമല്ല സഹായിച്ചിട്ടുള്ളത്. അതേസമയം അവരുടെ ഗവേഷണത്തിന് അനിവാര്യമായ ചില പരിമിതികൾ ഉണ്ടായിരുന്നു. ഈ പരിമിതികൾക്കു കാരണം അവർ ശാസ്ത്രീയവും വ്യക്തവുമായ ഒരു രീതിശാസ്ത്രം പിൻതുടർന്നിരുന്നില്ല എന്നതാണ്. ജ്യോതിഷ സൂചനകളെയും കലിദിനസൂചനകളെയുമാണ് അവർ പലപ്പോഴും കാല നിർണ്ണയത്തിന് ആശ്രയിച്ചത്. ഭാഷോല്പത്തിയെക്കുറിച്ചുള്ള ചില അഭ്യൂഹങ്ങളിലും കേരള ചരിത്രത്തെക്കുറിച്ചുള്ള ചില വൈയക്തിക സങ്കല്പങ്ങളിലും അധിഷ്ഠിതമായിരുന്നു അവരുടെ അന്വേഷണങ്ങളും നിഗമനങ്ങളും. അതുകൊണ്ടു തന്നെ, വളരെ നിസ്സാരങ്ങളായ കാര്യങ്ങളുടെ പേരിൽ ഈ ഗവേഷകർ കഠിനമായ ഏറ്റുമുട്ടലുകൾ നടത്തി. പ്രാചീനകവികളുടെ കാലത്തെയും കൃതികളെയും കുറിച്ചു നടത്തിയ ചർച്ചകളും തർക്കങ്ങളും ഇവിടെ ഓർക്കുക. മൂർത്തമായ തെളിവുകളുടെയോ വസ്തുതകളുടെയോ അടിസ്ഥാനത്തിലല്ല ഈ സംവാദങ്ങളിലധികവും നടന്നത് എന്നു വ്യക്തം. പലപ്പോഴും സർഗ്ഗ സാഹിത്യകൃതികളെ അവർ വിശ്വസനീയമായ ചരിത്ര സാമഗ്രികളായി കണ്ടുകൊണ്ടുള്ള ചർച്ചകൾ നടത്തിയിരുന്നു.[11] ഉണ്ണിയച്ചിയുടെയും ഉണ്ണിയാടിയുടെയും തറവാടുകളെക്കുറിച്ചും ഉണ്ണിനീലിയുടെ നിറത്തെക്കുറിച്ചും രാമായണം ചമ്പുവിന്റെ കർത്താവിനെക്കുറിച്ചും നമ്പ്യാരുടെ ജനനത്തെക്കുറിച്ചുമൊക്കെ നടന്ന ചർച്ചകൾ ഇന്നു നമ്മിലുളവാക്കുക വിസ്മയമായിരിക്കും. പാഠനിരൂപണങ്ങളിൽ താളിയോലകളിൽ പൊടിഞ്ഞുപോയ വരികൾ സ്വന്തം ഹിതത്തിനനുസരിച്ച് പൂരിപ്പിക്കാനും അവർക്കു വിഷമമുണ്ടായിരുന്നില്ല. എഴുത്തച്ഛന്റെ ഭാഗവതം കിളിപ്പാട്ടിന് പണ്ഡിതവരേണ്യനായ പി.കെ. നാരായണപിള്ള തയ്യാറാക്കിയ സംശോധിത സംസ്കരണം ഉളവാക്കിയ കോലാഹലം ഇവിടെ ഓർക്കേണ്ടതാണ്. കെ. രാമകൃഷ്ണപിള്ള അതിനെ ഒരു വ്യാജ പ്രമാണം എന്നാണു വിശേഷിപ്പിച്ചത്. വളരെ ക്ലേശം സഹിച്ച് മഹാകവി ഉള്ളൂരും ഇളങ്കുളവും ശൂരനാട്ടും ആറ്റൂർ കൃഷ്ണ പിഷാരടിയും നടത്തിയ ഗവേഷണവും ഗവേഷണ ഫലങ്ങളും ഇന്ന് നിഷ്കൃഷ്ടമായ പുനപ്പരിശോധന ആവശ്യപ്പെടുന്നത് അവർ ഒരുതരം രീതിശാസ്ത്രവും പാലിച്ചില്ല എന്നതുകൊണ്ടാണ്.

അപ്പോൾ രീതിശാസ്ത്രം ഒഴിവാക്കിക്കൊണ്ടുള്ള ഗവേഷണം അസാദ്ധ്യമാണ്. ഗവേഷണത്തിന്റെ പൊതുവായ അടിസ്ഥാനപ്രമാണങ്ങൾ അംഗീ

കരിക്കുമ്പോഴും സാഹിത്യ ഗവേഷണത്തിന് തനതായ ഒരു രീതി ശാസ്ത്ര മുണ്ടാവണം. സാഹിത്യമെന്ന ഇതരഭിന്നമായ വിദ്യാവിഭാഗത്തിന്റെ സാദ്ധ്യ തകളും സവിശേഷതകളും പരിമിതികളും ഉൾക്കൊള്ളുന്നതാവണം ഈ രീതി ശാസ്ത്രം.

ആസ്വാദനം സാഹിത്യ ഗവേഷണത്തിന്റെ ലക്ഷ്യമല്ല. ആരംഭ ബിന്ദു മാത്രമാണ് എന്ന് സൂചിപ്പിച്ചു. അവിടെ നിന്നു നടത്തുന്ന ചിട്ടയായ ധൈഷ ണിക അന്വേഷണമാണ് ഗവേഷണത്തെ ഫലദായകമാക്കുന്നത്. അതാ രെയും കവിയോ സാഹിത്യകാരനോ ആക്കുന്നില്ല. ഗവേഷണം ചെയ്യുന്ന യാൾക്ക് പാണ്ഡിത്യം ലഭിക്കുകയാണ് ചെയ്യുന്നത്. ഫലപ്രദമായ ഗവേഷണം ചെയ്യുമ്പോൾ ശാസ്ത്രീയവും വസ്തുനിഷ്ഠവുമായി സാഹിത്യത്തെ സമീ പിക്കാനുള്ള ശിക്ഷണം ലഭിക്കുന്നു. കൂടുതൽ അന്വേഷണങ്ങൾക്ക് ഈ ശിക്ഷണം സഹായകമാവുകയും ചെയ്യും. പാശ്ചാത്യ ചിന്തകന്മാർ ഗവേഷ ണത്തെ ഉന്നത വിദ്യാഭ്യാസത്തിലെ അദ്ധ്യാപനവൃത്തിയുമായി ബന്ധപ്പെ ടുത്തുന്നത് അതുകൊണ്ടാണ്.

പരാമർശസൂചകങ്ങൾ

1 അറിവും അനുഭൂതിയും, പുറം. 61

2 Need and Significance of the Study, Review of Literature, Methodology, Analysis, Conclusions and suggestions. ഇതാണ് സാമൂഹിക ശാസ്ത്ര വിഭാഗങ്ങളിലെ ഗവേഷണ പ്രബന്ധങ്ങളുടെ സാമാന്യ ഘടന.

3 "He requires a mind that should be free from the tyranny of mere theories", quoted in making of literature by Scott James, P. 295.

4 Much of what were calling criticism has traditionally been regarded as something different from scholarship, a matter of taste, feeling, subjective reaction or sensitivity statements produced by such factors, like the statements of the literature itself or Pseudo statements in the sense that they cannot be verified or refuted, The aims and methods of scholarship. P. 69

5 സാഹിത്യ വിമർശനത്തെക്കുറിച്ചുള്ള മാത്യു ആർനോൾഡിന്റെ കാഴ്ചപ്പാടിനോട് ഈ സമീപനത്തിനുള്ള അടുപ്പം വളരെ വ്യക്തമാണ്. "Culture and anarchy"യിലെ "The function of criticism at the present time" എന്ന ലേഖനം നോക്കുക.

6. ചാത്തനാത്ത് അച്യുതനുണ്ണി, ഗവേഷണം, പ്രബന്ധ രചനയുടെ തത്വങ്ങൾ, അവ താരിക പുറം. 11

7. He must translate his experience of literature into intellectual term assimilate it to a coherent scheme which must be rational if it is to be knowledge, Theory of literature P. 15

8. ഭാഷാപോഷിണി ഓഗസ്റ്റ് 1993. പുറം 26

9. അറിവും അനുഭൂതിയും പുറം. 168

10. Theory of literature P. 18

11. കെ. ദിലീപ്കുമാർ 'സംസ്കാര പഠനം' എന്ന പുസ്തകത്തിൽ സന്ദേശത്തിന്റെ സാംസ്കാരിക പാഠങ്ങൾ എന്ന പേരിലെഴുതിയ പ്രബന്ധത്തിൽ ഇതിന്റെ വിശ ദാംശങ്ങൾ ചർച്ചചെയ്യുന്നുണ്ട്.

പ്രബന്ധരചന വഴിതെറ്റുന്നതെങ്ങനെ?

സാഹിത്യഗവേഷണത്തെ സംബന്ധിച്ച സാമാന്യമായ ചില കാര്യങ്ങളാണ് ഇതുവരെ ചർച്ചചെയ്തത്. ഈ തത്ത്വങ്ങളുടെ പരിധി ലംഘിക്കാതെ ഓരോ ഗവേഷണ വിഷയത്തിനും അനുയോജ്യമായ രീതിശാസ്ത്രം മാർഗ്ഗദർശിയും ഗവേഷണ വിദ്യാർത്ഥിയും ചേർന്ന് രൂപപ്പെടുത്തുകയാണ് വേണ്ടത്. സാഹിത്യ ഗവേഷണത്തെ സംബന്ധിച്ചിടത്തോളം പൂർവനിശ്ചിതമായ, മാറ്റമില്ലാത്ത, ബലിഷ്ഠമായ ഒരു രീതിശാസ്ത്രം രൂപപ്പെടുത്തിവയ്ക്കുക സാദ്ധ്യമല്ല. അത്രമാത്രം വൈവിദ്ധ്യം ഗവേഷണവിഷയങ്ങൾക്കുണ്ട്.

ഇവിടെ ഉദാഹരണമായി സ്വീകരിച്ചത് താരതമ്യേന ലളിതമായ ഒരു വിഷയമാണ്. സമകാല സിദ്ധാന്തങ്ങൾ പ്രയുക്തമാകുന്ന കൂടുതൽ സങ്കീർണ്ണമായ വിഷയങ്ങൾ, സ്വീകരിക്കുമ്പോൾ, അതിനനുസരിച്ച് രീതിശാസ്ത്രത്തിലും ചില മാറ്റങ്ങൾ വരുത്തേണ്ടിവരും. എങ്കിലും ഗവേഷണത്തിന്റെ വസ്തുനിഷ്ഠതയും ക്രമബദ്ധതയും നിലനിർത്തുക തന്നെവേണം. ഭാഷ സാങ്കേതിക സംജ്ഞകൾകൊണ്ട് സങ്കീർണ്ണമാകുമ്പോൾ, പുതുതായുപയോഗിക്കുന്ന സംജ്ഞകളുടെ ഒരു ഗ്ലോസറി അനുബന്ധമായി ചേർക്കുന്നതും നല്ലതാണ്.

പുതിയ സിദ്ധാന്തങ്ങൾക്കനുസരണമായ മാറ്റം രീതിശാസ്ത്രത്തിനും അനിവാര്യമല്ലേ എന്ന ചോദ്യം ഇന്ന് ഉയർന്നുകേൾക്കുന്നുണ്ട്. ഇതൊരു പോസ്റ്റഡറിഡിയൻ സന്ത്രാസത്തിൽ നിന്നുയിർക്കൊള്ളുന്നതാണ്. പാശ്ചാത്യ വിമർശനത്തിന്റെ വികാസ പരിണാമങ്ങളെക്കുറിച്ചുള്ള വ്യക്തമായ ധാരണയുടെ അഭാവമാണതിനു പിന്നിൽ. പ്ലേറ്റോ മുതൽ ഇന്നുവരെ പാശ്ചാത്യ വിമർശന ചരിത്രത്തിലെത്രയോ സിദ്ധാന്തങ്ങൾ രൂപപ്പെട്ടിട്ടുണ്ട്. ഇവയിലേതു സിദ്ധാന്തത്തിനാണ് സാർവകാലികമായ അംഗീകാരം ലഭിച്ചിട്ടുള്ളത്? ഒന്നിനെ നിഷേധിച്ചും പരിഷ്കരിച്ചും മറ്റൊന്നുണ്ടാകുന്നു. അതും നിരസിക്കപ്പെടുന്നു, ഇതല്ലേ സത്യം? അരിസ്റ്റോട്ടിൽ മറികടക്കപ്പെട്ടെങ്കിൽ ഡറിഡയും മറികടക്കപ്പെടുകതന്നെ ചെയ്യും. പാശ്ചാത്യവിമർശനത്തിൽ ഘടനാവാദവും അപനിർമ്മാണവും നേരിട്ടിട്ടുള്ളത്ര എതിർപ്പ് മറ്റൊരു സിദ്ധാന്തവും നേരിട്ടിട്ടില്ല. വാക്കുകളുടെ അർത്ഥത്തെക്കുറിച്ചുള്ള ഡറിഡയുടെ ഉപദർശനം തിരസ്കരിക്കപ്പെടുന്നതോടെ അത് സൃഷ്ടിച്ചിരിക്കുന്ന ഇന്നത്തെ ഡൈഷണിക മായ അടിമത്തവും അവസാനിക്കും. ഭാഷാശാസ്ത്രപരമായ ഒരു (കു?)യുക്തിയിൽ പടുത്തുയർത്തപ്പെട്ടതാണ് അത്. ഈ യുക്തി ഇന്നേ ചോദ്യംചെയ്യപ്പെട്ടുതുടങ്ങിയിരിക്കുന്നു. കേരളപാണിനി പൂർവസൂരികളുടെ ചിന്താബലത്തിൽ സ്ഥാപിച്ചിട്ടുള്ള അഭിധാനിർണ്ണായക തത്ത്വങ്ങളുടെ മുന്നിൽപ്പോലും

നിലനില്ക്കാനുള്ള സ്ഥൈര്യം ആ യുക്തിക്കുണ്ടെന്നു പറഞ്ഞുകൂടാ. ഇതാണ് സത്യമെന്നിരിക്കെ മാറിമാറി വരുന്ന കാവ്യസിദ്ധാന്തങ്ങൾക്കനുസരിച്ച് ഗവേഷണത്തിന്റെ രീതിശാസ്ത്രത്തിൽ മാറ്റം വരുത്താൻ കഴിയുമോ? പ്രയോഗതലത്തിൽ അനിവാര്യമായ ചില നീക്കുപോക്കുകൾക്ക് തയ്യാറാവേണ്ടിവരുമെന്നേ പറയാൻ കഴിയൂ.

ഇവിടെ ഓർക്കേണ്ടൊരു കാര്യം അർത്ഥത്തിന്റെ ആധികാരികതയല്ല. ഗവേഷകൻ അംഗീകരിക്കുന്ന അല്ലെങ്കിൽ വായിച്ചെടുക്കുന്ന അർത്ഥത്തിന് അയാൾ നല്കുന്ന യുക്തി ഭദ്രതയാണ് പ്രധാനം. സമാന്തരമായി മറ്റുചില അർത്ഥ സാദ്ധ്യതകളുണ്ടാകുമ്പോൾ, താനംഗീകരിക്കുന്ന അർത്ഥത്തിന്റെ സാധുത്വം വാദിച്ച് സമർത്ഥിക്കേണ്ടിവരും. മറിച്ച് അങ്ങനെയുമാവാം ഇങ്ങനെയുമാവാം, അതും ശരി ഇതും ശരിയെന്ന നിലപാടു സ്വീകരിച്ചാൽ അവിടെ ഒരു തീസിസുമുണ്ടാവില്ല. മറ്റാരുടേയും നിലപാടിനെ നിരുപാധികം പിന്തുടരുകയല്ല, സ്വന്തം നിലപാടു കണ്ടെത്തുകയാണ് ഗവേഷകൻ ചെയ്യേണ്ടത്.

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നമ്മുടെ ഗവേഷണ പ്രബന്ധങ്ങൾ പരിമിതമായിത്തീരുന്നതിന് വ്യക്തമായ ചില കാരണങ്ങളുണ്ട്. ഇതിൽ ഏറ്റവും പ്രധാനം ഒരു തീസിസില്ലാതെ പ്രബന്ധം തയ്യാറാക്കുന്നതാണ്.

പ്രൊഫ. മുണ്ടശ്ശേരി തന്റെ നാടകാന്തം കവിത്വം എന്ന പുസ്തകത്തിന്റെ ആമുഖത്തിൽ പറയുന്നു 'ഞാൻ വളരെക്കാലമായി മനസ്സിൽ കൊണ്ടുനടക്കുന്ന ഒരു തീസിസാണ് ഇപ്പോൾ പുസ്തകരൂപത്തിൽ അവതരിപ്പിക്കുന്നതെന്ന്'. 'സാഹിത്യത്തെ കലാത്മകവും സഫലവുമാക്കുന്നത് നാടകീയതയാണ്' ഇതാണ് അദ്ദേഹത്തിന്റെ തീസിസ്. ഈ തീസിസ് വായനക്കാരന് ബോദ്ധ്യപ്പെടുന്ന വിധത്തിൽ ശാസ്ത്രീയമായി അവതരിപ്പിക്കാനാണ് പല അദ്ധ്യായങ്ങളായി പ്രബന്ധം സംവിധാനം ചെയ്യുന്നത്. അദ്ധ്യായങ്ങൾക്കു തമ്മിൽ യുക്തിപരമായ തുടർച്ചയുണ്ടെന്ന് ഉറപ്പുവരുത്തുകയും ചെയ്തിരിക്കുന്നു. ആ പുസ്തകം കുറേ ഉപന്യാസങ്ങളുടെ സമാഹാരമല്ല. അതിലെ ഏതെങ്കിലും ഒരദ്ധ്യായത്തിനു മാത്രമായി സ്വതന്ത്രമായ നിലനില്പുമില്ല.

സാഹിത്യം വെറുമൊരു കലയല്ല 'വിദ്യ' യാണെന്നത് കുട്ടികൃഷ്ണമാരാരുടെ ഒരു തീസിസാണ്. അദ്ദേഹം പല അദ്ധ്യായങ്ങളായി സംവിധാനം ചെയ്ത് അത് പുസ്തകരൂപത്തിൽ അവതരിപ്പിച്ചില്ല. കാച്ചിക്കുറുക്കിയ ഒരൊറ്റ ഉപന്യാസമാക്കി മാറ്റുകയാണ് ചെയ്തത്. പക്ഷേ ഒരു ഗവേഷണ പ്രബന്ധത്തിന്റെ കെട്ടുറപ്പും ജൈവഘടനയും അതിനുണ്ട്.

ഏതു ഗവേഷണ പ്രബന്ധം എഴുതാൻ തുടങ്ങുന്നതിന് മുൻപും വിദ്യാർത്ഥിയും മാർഗ്ഗദർശിയും ചോദിക്കേണ്ട പ്രധാന ചോദ്യമാണ് അവതരിപ്പിക്കാൻ പാകത്തിൽ ഒരു തീസിസ് രൂപപ്പെട്ടിട്ടുണ്ടോ എന്നത്.

പ്രൊഫ. സുകുമാർ അഴീക്കോടിന്റെ 'മലയാള സാഹിത്യ വിമർശനം' ഒരു ഗവേഷണ പ്രബന്ധമാണ്. പക്ഷേ അതിന് ജൈവമായ ഘടനയില്ല. അതിലെ ഏതദ്ധ്യായം കീറിയെടുത്താലും സ്വയം പര്യാപ്തമായ ഉപന്യാസമാവും 'മലയാള സാഹിത്യ വിമർശനത്തിലെ വൈദേശിക പ്രചോദന'മായി

രുന്നു ഗവേഷണ വിഷയം. പക്ഷേ വ്യക്തമായ ഒരു തീസിസില്ലാതെ എഴുതിയപ്പോൾ അത് മലയാള വിമർശനത്തിന്റെ അപര്യാപ്തമായ ചരിത്രമായിപ്പോയി. അദ്ദേഹം ആ ഗവേഷണ പ്രബന്ധത്തിന്, കാര്യമായ മാറ്റമൊന്നും വരുത്താതെയാണ് മലയാള സാഹിത്യ വിമർശനം എന്ന പേരുനല്കി പ്രസിദ്ധീകരിച്ചത്.

എങ്ങനെയാണ് മലയാള വിമർശനത്തിലെ വൈദേശിക പ്രചോദനത്തെക്കുറിച്ചുള്ള അന്വേഷണത്തിന് ഒരു സാഹിത്യ ചരിത്രമാവാൻ കഴിയുക? ഈ പുസ്തകം പുറത്തുവന്ന കാലത്ത് തന്നെ കെ.പി. അപ്പൻ ഇക്കാര്യം രൂക്ഷമായ ഭാഷയിൽ ചൂണ്ടിക്കാണിക്കുകയും ചെയ്തു.

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പിന്നെ സംഭവിക്കുന്നത് വിഷയത്തിന്റെ കേന്ദ്രസ്ഥമായ ആശയത്തിന് പ്രാധാന്യം കിട്ടാതെ പോവുകയാണ്. വൈലോപ്പിള്ളിക്കവിതയിലെ മാർക്സിയൻ സ്വാധീനത്തെക്കുറിച്ചുള്ള പ്രബന്ധത്തിൽ ആകെ ആറ് അദ്ധ്യായമുണ്ടാവുക. ആദ്യത്തെ നാല് അദ്ധ്യായവും മാർക്സിസവും മാർക്സിയൻ സൗന്ദര്യശാസ്ത്രവും ചർച്ചചെയ്യാൻ മാറ്റിവയ്ക്കുകയും ഒരദ്ധ്യായത്തിൽ വൈലോപ്പിള്ളിക്കവിതയിലെ മാർക്സിയൻ സ്വാധീനം പരാമർശിച്ച് ഉപസംഹാരത്തിലെത്തുകയും ചെയ്യുക. ഇതിനെക്കാൾ അശാസ്ത്രീയമായ ഒരു സമീപനം ഉണ്ടാകാൻ കഴിയുമോ? അടുത്തകാലത്ത് പരിശോധിക്കേണ്ടിവന്ന പല പ്രബന്ധങ്ങളുടെയും ഘടനയിതാണ്.

സിദ്ധാന്തങ്ങളെ മുൻനിറുത്തി നടത്തുന്ന ഗവേഷണങ്ങളിൽ കാണുന്ന ഒരു പ്രവണതയുണ്ട്. ആദ്യ അദ്ധ്യായത്തിൽ ഒരു വിവേകവും കൂടാതെ സിദ്ധാന്തത്തിന്റെ ചരിത്രവും ഉൾപ്പിരിവുകളും എല്ലാം അനഗാധമായിട്ടാണെങ്കിലും വിസ്തരിച്ച് പ്രതിപാദിക്കലാണത്. യഥാർത്ഥ ഗവേഷണ വിഷയത്തിന്റെ വിശകലനത്തിന് ഈ സിദ്ധാന്ത വിവരണത്തിലെ നന്നേ കുറച്ചു കാര്യങ്ങളെ പ്രയോജനപ്പെടൂ. സാറാ ജോസഫിന്റെ നോവലുകളെക്കുറിച്ച് ഫെമിനിസത്തിന്റെ അടിസ്ഥാനത്തിൽ നടത്തുന്ന അന്വേഷണമാണെന്നിരിക്കട്ടെ ആദ്യ അദ്ധ്യായത്തിൽ ഫെമിനിസത്തിന്റെ ഉത്ഭവവും വികാസ പരിണാമങ്ങളും അതിന്റെ വ്യത്യസ്ത ശാഖകളുമൊക്കെ ചർച്ചചെയ്യേണ്ടതുണ്ടോ? സൈദ്ധാന്തിക ഭൂമികയ്ക്ക് അത്യാവശ്യം വേണ്ട ഫെമിനിസ്റ്റ് ആശയങ്ങൾ മാത്രം ഉദ്ഗ്രഥിച്ചാൽപ്പോരെ? ഫ്രാൻസിലും, ഇംഗ്ലണ്ടിലും ജർമ്മനിയിലും അതെങ്ങനെ വളർന്നു എന്ന ചരിത്ര കഥനത്തിനെന്തു പ്രസക്തി? ഇപ്പോഴത്തെ നിലയ്ക്ക് ഫെമിനിസവുമായി ബന്ധപ്പെട്ട ഒരു തീസിസിലെ ആദ്യ അദ്ധ്യായം ഫെമിനിസവുമായി ബന്ധപ്പെട്ട ഏതു തീസിസിലേയ്ക്കും 'ട്രാൻസ്ഫർ' ചെയ്യാവുന്നതേയുള്ളൂ. ഇവിടെ സൈദ്ധാന്തിക ചർച്ചയ്ക്ക് തീസിസുമായുള്ള ബന്ധം വളരെ അകന്നതാണ് എന്നുസാരം.

സ്വാധീനതാ പഠനത്തിൽ ഊന്നുന്ന ഒരു ഗവേഷണ പ്രബന്ധത്തിന്റെ ആദ്യ അദ്ധ്യായത്തിൽ താരതമ്യ സാഹിത്യത്തെക്കുറിച്ച് ഇന്നോളം നടന്നിട്ടുള്ള സകല പരാമർശങ്ങളും വിസ്തരിച്ച് രേഖപ്പെടുത്തണമെന്നുണ്ടോ? എന്താണ് സ്വാധീനം? എങ്ങനെയൊക്കെ സ്വാധീനമുണ്ടാവാം? എപ്പോഴാണ്

സ്വാധീനം അനുകരണമാവുക? എപ്പോഴാണ് സർഗ്ഗാത്മകമാവുക? ഈ കാര്യങ്ങൾ മാത്രം പരാമർശിച്ച് നേരേ വിഷയത്തിലേയ്ക്ക് കടക്കുകയല്ലേ യുക്തം?

ഇനി മറ്റൊരുതരമെഴുത്തുണ്ട്. മലയാളത്തിലെ നവോത്ഥാനകാല ചെറുകഥയിലെ ഹ്യൂമനിസ്റ്റ് പ്രവണതകളെക്കുറിച്ചാണ് അന്വേഷിക്കേണ്ടതെന്നിരിക്കട്ടെ. അവർ തുടങ്ങുക ചെറുകഥ ലോക സാഹിത്യത്തിൽ, ചെറുകഥ ഭാരതീയ സാഹിത്യത്തിൽ, പിന്നെ മലയാള ചെറുകഥ നവോത്ഥാന കാലംവരെ എന്നിങ്ങനെയാവും. വളരെ വിപുലമായ ഈ പടിപ്പുരകെട്ടലിനെന്തു പ്രസക്തി? ലോക ചെറുകഥയെക്കുറിച്ചും ഭാരതീയ ചെറുകഥയെക്കുറിച്ചും വിജ്ഞാനകോശങ്ങളിൽ നിന്നു കിട്ടുന്ന 'ദ്വിതീയാകര' വസ്തുതകളെ അപ്പാടെ പകർത്തിവയ്ക്കലിൽ കവിഞ്ഞെന്തെങ്കിലും സംഭവിക്കുമോ? ഗവേഷകന്റെ മൗലികാന്വേഷണത്തിന്റെ മുദ്ര പതിഞ്ഞിട്ടില്ലാത്ത ഈ പരപ്പൻ അന്വേഷണത്തിന് ഗവേഷണ പ്രബന്ധത്തിലെന്തു പ്രസക്തി? എന്താണ് ഹ്യൂമനിസം? അതിനു നവോത്ഥാനകാല ചെറുകഥയിലുള്ള സവിശേഷ പ്രാധാന്യമെന്ത്? എന്നീ കാര്യങ്ങൾ വ്യക്തമാക്കി നേരേ വിഷയാപഗ്രഥനത്തിലേയ്ക്ക് കടക്കുകയല്ലേ ശരി? മലയാളത്തിലെ പി.എച്ച്.ഡി. പ്രബന്ധം കുറഞ്ഞത് ഒരു അഞ്ഞൂറുപേജെങ്കിലുമുണ്ടാവണമെന്ന പഴയ ധാരണയാണ് ആവശ്യമില്ലാത്ത പലതും ഇങ്ങനെ വിസ്തരിക്കാനിട വരുത്തുന്നത്. തീസിസിന്റെ വ്യാപ്തമാണ് പ്രബന്ധത്തിന്റെ വലുപ്പം നിർണ്ണയിക്കേണ്ടത്. അല്ലാതെ വെറുതേ നടത്തുന്ന പടപ്പിൽ തല്ലലുകളല്ല.

പല പ്രബന്ധങ്ങളുടെയും ദൗർബല്യം അദ്ധ്യായങ്ങളുടെ അനുപാതദീക്ഷയില്ലായ്മയാണ്. ഒരദ്ധ്യായം മുപ്പതു പുറമാകുമ്പോൾ മറ്റൊരദ്ധ്യായം ഇരുപത്തഞ്ചോ ഇരുപതോ പുറമാവാം. പക്ഷേ ഒരദ്ധ്യായം എൺപതു പുറവും മറ്റൊന്ന് പതിനാല് പുറവുമായാലോ? അദ്ധ്യായ വിഭജനത്തിനെന്തോ അപകടം സംഭവിച്ചിട്ടുണ്ടെന്നാണ് അത് തരുന്ന സൂചന. തീസിസിന്റെ സങ്കല്പനത്തിനു തന്നെ എന്തോ കുഴപ്പം സംഭവിച്ചിട്ടുണ്ടെന്നും ധരിക്കണം.

ഒരെഴുത്തുകാരനെക്കുറിച്ച് ഗവേഷണം ചെയ്യാൻ തുടങ്ങുന്നയാൾ അയാളെ അനർഹമായി ആദർശവത്ക്കരിക്കാനോ അയാൾ നിസ്തുല പ്രതിഭാശാലിയാണെന്ന് സമർത്ഥിക്കാനോ ഉള്ള ബാദ്ധ്യത ഏറ്റെടുക്കുന്നില്ല. സാഹിത്യ പ്രസ്ഥാനത്തെയും സാഹിത്യ പ്രവണതയേയും കുറിച്ചന്വേഷിക്കുന്ന ഗവേഷകനും അത്തരമൊരു ബാദ്ധ്യതയില്ല. ഡേറ്റയുടെ അപഗ്രഥനത്തിൽ നിന്ന് വസ്തുനിഷ്ഠവും സത്യസന്ധവുമായ നിഗമനത്തിൽ എത്തിച്ചേരാനേ പാടുള്ളൂ. പല ഗവേഷകരും ഈ കാര്യം മറന്നുപോകുന്നു.

ഇത്തരം പരിമിതികൾ നിറഞ്ഞ പ്രബന്ധങ്ങൾ അവധാനപൂർവം മാറ്റിയെഴുതി വീണ്ടും സമർപ്പിക്കാൻ നിർദ്ദേശിക്കുന്നതിൽ ധാർമ്മികമായ നൊമ്പരമൊന്നും പരീക്ഷകൻ അനുഭവിക്കേണ്ടതില്ല. തീസിസുകളെല്ലാം തന്നെ പുസ്തകരൂപത്തിൽ പ്രസിദ്ധീകരിക്കപ്പെടില്ല. പക്ഷേ അവയെല്ലാം ധാരാളമായി 'റെഫർ' ചെയ്യപ്പെടും.

D9. Animal Experimentation – Ethical, Legal Issues[12]

Animals have played a very important role in the life of human beings and experimentation in animals has given us enormous information and knowledge to understand several diseases. Currently, animals are used in the areas of biological sciences of fundamental nature, research & development, quality control of products, devices for human medicine, dentistry, veterinary medicine, preclinical toxicological evaluation and other safety evaluations of vaccines and antibodies. Animals are also required for disease diagnosis, teaching and training. Various Animals from Nematodes to Monkeys were used for scientific experiments and teaching (biology / medicine). In modern time experiments in animals revolve around mammals as they are closer to Human beings in general. Protozoans, Insects, Fishes, Mice, Rats, Rabbits, Guinea pigs, Hamsters, Cats, Dogs, and Monkeys are also used appropriately as per the requirement /objective the study. Among these mice and rat are used in large numbers, when compared to the number of other animals used. In the recent times, use of animals in academic institutions and universities has been banned especially for dissections & demonstrations for under graduates.

At the time when users required quality animals free from any diseases and when there were no facilities in the country that provide quality laboratory animals and demand for genetically defined animals came up with Council of International Organizations of Medical Sciences (CIOMS), International Union of Biological Sciences (IUBS) and UNESCO have met in Paris on 3-4th November 1956 with the aim to raise the standards in the use of laboratory animals on a global basis and took a decision to establish independent centers in various countries. A centre was created in India too exclusively for Laboratory Animal Science for the first time way back in 1957 in Mumbai before even the PCA Act came into existence. This centre was called Laboratory Animal Information Service (LAISC) with the funding support from UNESCO. Subsequently it was taken over by ICMR in 1959. The unit had undertaken survey for more than 2 years to understand the problems that existed within those scientific fields in which live animals were used for experimental procedures. The centre continues to be under ICMR and shifted to

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Hyderabad in 1976 and is now known as National Centre for Laboratory Animals Sciences (NCLAS).

Legal Provisions: There was an increase in the number of Animals used for experiments till 2012 and observed a decline there after due to formulation of various rules and regulations during this period to Control and Supervise Experiments on Animals. India's first national animal welfare law is the the Prevention of Cruelty to Animals Act, 1960, which criminalizes cruelty to animals, though exceptions are made for the treatment of animals used for food and scientific experiments. Currently in India, experimentation on animals is covered under the provisions of Prevention of Cruelty to Animals Act, (PCA Act) 1960 and the Rules under the amended Act of 1998 and 2001. This is implemented through a committee called "Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA)". It is a statutory body which was established in 1964 under Section 15(1) of Chapter 4, of the PCA Act under the Ministry of Environment Forest & Climate Change. This Committee ensures registration of establishments and overviews housing, feeding, conduct of experimental procedures in animals in the institution through its appointed members and nominees in the Institutional Animal Ethics Committee. The main objective of the Committee is to ensure judicious use of animals in research. The committee emphasizes on implementation of 4R principles Replacement, Reduction, Refinement and Rehabilitation. Accordingly, committee critically reviews and suggests alternative methods and appropriate models wherever possible. It helps in reducing the numbers of animals and refines it by promoting sophisticated methods to alleviate pain and distress during experimentation. It suggests rehabilitation of large animals (above rabbits) following experimentation with defined norms already published in the website. At present, in India, there are more than 2300 animal facilities registered with CPCSEA for conducting experiments using animals. In Kerala there are about 62 registered facilities including the Animal facility in the Department of Biochemistry, Kariavattom.

The 1960 law also created the Animal Welfare Board of India to ensure the anti-cruelty provisions and to promote animal welfare. Subsequent laws have placed regulations and restrictions on the use of draught animals, the use of performing animals, animal transport, animal slaughter, and animal experimentation. The Breeding and Experiments on Animals (Control and Supervision) Rules, 1998 sets general requirements for breeding and using animals for research. A 2006 amendment specifies that experimenters must first try to use animals "lowest on the phylogenetic scale", use the minimum number of animals for 95% statistical confidence, and justify not using non-animal alternatives. A 2013 amendment bans the use of live animal experiments in medical education. In 2013

India made it illegal to use captive dolphins for public entertainment. In 2014 India became the first country in Asia to ban all testing of cosmetics on animals and the import of cosmetics tested on animals. India has a grade of C out of possible grades A, B, C, D, E, F, and G on World Animal Protection's Animal Protection Index.

Need for Guidelines: As per the guidelines given by CPCSEA, Stricter of control of physical environment and good quality feed & water is required for obtaining reliable experimental results. Many institutions failed to reach the expectations of CPCSEA in terms of providing the required environmental, social and food enrichment to the animals as per guidelines. Most important is reduction of unnecessary pain, suffering and wasteful use of animals. Committee spelt out in Chapter 4 of the PCA Act 1960 Rule 17 (d) which states that 'experiments on animals are avoided wherever it is possible to do so; as for example; in medical schools, hospitals, colleges and the like, if other teaching devices such as books, models, films and the like, may equally suffice." The Committee is empowered to take all measures to ensure that animals are not subjected to unnecessary pain or suffering during and after the performance of experiments. They are directed to use effective alternatives in the form of CD's, computer simulations, mannequin models, in- vitro methods, etc. these are found to be effective pedagogic models for teaching anatomy physiology Pharmacy sciences etc. In view of the above Rule 17 (d) of the PCA Act, this is binding on all academic institutions using animals in dissection and experimentation. University Grants Commission directed the establishments, colleges, institutions registered under UGC to use alternatives in the teaching of anatomy, physiology, zoology etc and completely ban the use of animals for dissection and experimentation in the teaching of Pharmacy, Life sciences at the undergraduate level and post graduate levels. UGC recommendations were; 1. To strictly adhere to the Wild Life Protection Act, 1972 and the Prevention of Cruelty to Animals Act, 1960; 2. To constitute a Dissection Monitoring Committees (DMC) to look into the use of animals; 3. For both UG and PG programs, there shall be reduction in the number of animals for dissection and experimentation as well as in the number of species with all ethical considerations. Preference shall be given to laboratory bred animal models; 4. For under graduates only one species is allowed for demonstration by the faculty; students should not do any dissection; 5. PG Students have the option to perform dissection of selected species as per the curriculum or to have a project related to biodiversity/biosystematics etc. The recommendations were approved by the UGC and Ministry of Human Resource Development. The issued guidelines will apply to all departments in universities and colleges dealing with animals in teaching and research under UGC. Medical Council of India (MCI) in its gazette 19th March, 2014 notified that "For teaching Physiology and

Pharmacology in UG curriculum, the required knowledge, skills training should be given by using Computer Assisted modules. Pharmacy Council of India had also issued a circular to all institutions under PCI to register with CPCSEA and implement the guidelines of CPCSEA for experimentation on animals. Under the existing rules all registered institutions can perform experiments on animals with the approval of IAEC after a thorough evaluation in its meeting with a full quorum of members' participation. On many occasions, members and representatives of inspection teams from CPCSEA while inspecting and while recommending for registration or renewal of the college facilities insists that, they should fulfill all specifications mentioned in the guidelines. The guidelines are broad based to cover various institutions involved in breeding and supply, performing testing of final products, conducting experimentation as part of R&D and institutions performing Contract Research. As such there are no specific and separate guidelines for all these institutions having different activities. Similarly, no specific guidelines have been laid down for pharmacy colleges, medical colleges and university colleges where in very few experiments are performed in a year. CPCSEA has already categorized organizations in to government, private, conventional, barrier, CRO etc while issuing their license during registration.

Animal Welfare: A good researcher is recommended to have a utilitarian view towards conducting animal experiments which maximize human and animal well being. Here animals like humans, deserves morale consideration and must therefore consider welfare consequences of animals as well as potential benefits for humans. It is essential to implement a humane care program, along with creation of a laboratory environment in which humane care and respect for animals are valued and encouraged. Humane means those actions taken to ensure that laboratory animals are treated according to high ethical and scientific standards. The UK government's Farm Animal Welfare Council has developed the 'Five Freedoms 'strategy as a means of assessing animal welfare in captive situations:- (1) Freedom from hunger and thirst – ready access to water and a diet to maintain health and vigor. (2) Freedom from discomfort – by providing a suitable environment. (3) Freedom from pain, injury and disease – by prevention or treatment. (4) Freedom from fear and distress – by providing conditions which avoid mental suffering. (5) Freedom to express natural behavior– by providing sufficient space and adequate facilities. Using the Five Freedoms criteria enables identification of situations which compromise good animal welfare, that is, situations which cause fear, pain, discomfort, injury, disease, or behavioral distress. This policy has been adopted in many countries. Many times animal experimentation is necessary as in vitro alternate methods cannot

replace the animal experimentation totally, but can reduce the number of animals to the extent possible.

Various Guidelines for Use of Animals in Bio-Medical Research

- Approved Guidelines by CPCSEA on the norms and practices for regulation of Animal Experimentation
- CPCSEA Guidelines for Laboratory Animal Facility
- National Science Academy (INSA) Guidelines for Care and Use of Animals in Scientific Research
- ICMR Guidelines for use of Laboratory Animals in Medical Colleges

Acts and Rules

- The Prevention of Cruelty to Animals Act 1960 (59 0f 1960) link : www.awbi.org
- The Breeding of and Experiments on Animals (Control and Supervision) Rules,1998 :http://envfor.nic.in/legis/awbi/awbi10.pdf
- The Breeding of and Experiments on Animals (Control and Supervision) Amendment Rules, 2001. http://envfor.nic.in/legis/awbi/awbi11.pdf

D10. Do-it-yourself: Guide for Fair Tests[13]

Which brand of chocolate chip makes the best tasting cookies? Is the tree outside your window causing your runny nose? Why won't your car start? If you want to answer questions like these, you'll probably need to do some testing. But all tests are not created equal. In order to figure out the real answers to such questions, you'll need to test your ideas in a fair way.

Testing can help you pick the tastiest brand of chocolate chip, figure out why you're sneezing, or find out why your car won't start.

The considerations that go into making "everyday" tests fair are the same ones that scientists consider when they test their ideas using experiments and other methods. Whether one wants to optimize a chocolate chip cookie recipe, develop effective treatments for Alzheimer disease, learn more about how mass extinctions work, or investigate the workings of gravity, the components of a fair test are the same:

Comparing outcomes: To be confident in test results, it's generally important to have something to compare them to. So, for example, in your cookie test, you'd want to actually compare batches of cookies made with different brands of chocolate chips. You might also want to make a batch without any chocolate chips at all — just to make sure that the chocolate chips are really making a difference in the cookies' taste. Making just one batch of cookies with one brand of chocolate and seeing how they taste wouldn't help answer your question. In experiments, whatever you are comparing your test results to is sometimes called the control group or control treatment. But don't confuse the control group with …

Controlling variables: In most tests, we want to be confident in the relationship between cause and effect. Is it *really* the chocolate chip brand, and not the baking temperature, that

[13] "Fair tests: A do-it-yourself guide", Understanding Science, University of California Museum of Paleontology, 19 January 2018, P*ermission of Trish Roque, Web Manager vide email dated 04.01.2018 is acknowledged.*

makes one cookie taste better than another? To be able to make a strong statement about cause and effect, you'll need to control variables — that is, try to keep everything about the test comparisons the same, *except* for the variables you're interested in. So in the cookie case, this would mean, for each batch standardizing the dough recipe, the method for mixing and baking the dough, and the procedure for tasting and rating the cookies. The only element that should vary across batches is the one variable you're interested in: brand of chocolate.

Avoiding bias: No matter how hard we humans try to be objective, bias can sneak into our observations and judgments. In a sense, bias occurs because it's very difficult to "control" variables associated with human judgments. For example, your cookie tasters might be hungry and so the first cookie they eat could seem tastier to them than the rest. To avoid this potential source of bias, you'd want to set up the test so that different testers taste the cookies in different orders. And if testers knew which cookies were made with which brands of chocolate they might be subconsciously biased towards more expensive chocolate brands. To avoid this, you could label your cookie batches with letters instead of brand names. It's even possible that you, the cookie baker, would give subtle clues to your tasters if you knew that Cookie B was made with your personal favorite brand of chocolate. So, you might want to arrange to stay out of the room while the tasting is going on.

Distinguishing chance from real differences: All sorts of subtle things that you either don't or cannot control can affect the outcome of a test. Some cookies in a batch might have wound up with a few less chocolate chips than others. The oven might have heated unevenly and burnt a few cookies. One taster might have been distracted during the test and not given careful ratings. All of these random factors will affect the outcome of the test — but in small ways. So how do you know if the difference between a cookie with an average rating of 4.1 and one with an average rating of 4.25 is due to random factors or a real difference in chocolate brand? First, sample size is important. Cookies from each batch should be rated by many different people. The larger your sample size, the more likely it is that these random factors will cancel each other out and that real differences (if they exist) can be detected statistically — which leads to our second point: Statistics can be used to analyze your raw data. The purpose of conducting such statistical tests is to tell you how likely it is that a difference in rating likes the one that you observed is actually due to random factors.

Detecting the Differences: Statistics & Sample Size

You might be wondering, what counts as a "large" sample size? Twenty, 200, or 2000 chocolate chip cookies? Well, it depends on how small a difference between groups you want to be able to detect. If you are interested in very tiny differences (e.g., subtle differences between chocolate chip brands), you need a very large sample size, and if you only care about pretty big differences (e.g., the difference between yummy and disgusting), you can get away with a smaller sample size. The appropriate sample size depends on the statistical tests you want to run and the sorts of differences you want to detect.

It is often impossible to make a test perfectly fair, and each issue listed above may be more or less important for a particular test — but by considering each of these factors in how your test is designed, you can maximize the amount of useful information you get from the test.

Above, we gave an example of testing in everyday life, but the same set of considerations can be applied to tests in more traditionally scientific realms — and to tests that don't involve experiments. See real-life examples of fair test design in science below:

II. Fair tests in the field of medicine: Aiding Alzheimer Patients

A *Ginkgo biloba* leaf

The plant *Ginkgo biloba* has been used in traditional medicine for thousands of years. Doctor and medical researcher Pierre Le Bars and his colleagues[1] wanted to figure out whether Ginkgo could be safely used to treat symptoms of dementia caused by Alzheimer disease or multiple strokes. Here's the test they designed to help.

The Le Bars study used a placebo — pills containing inactive ingredients — to help control variables.

Comparing outcomes: Le Bars and his colleagues set up an experiment in which one group of dementia patients received Ginkgo extract (the experimental group), and another (the control group) did not. The researchers then compared dementia symptoms in the two groups over the next 52 weeks of the treatment.

Answer their question: **Controlling variables**: To try to rule out other differences that might influence dementia symptoms, only dementia patients without other serious medical problems were asked to participate in the study. The researchers also assessed all participants' dementia symptoms in the same way and at around the same time, and they ensured that everyone in the experimental group received the same dose of Ginkgo extract. The study aimed to have the only consistent difference between the two groups be whether or not the patients were receiving Ginkgo extract — but in much medical research, this presents a problem. If patients know that they are receiving a special treatment, this knowledge alone can affect their symptoms, behavior, and possibly even the course of a disease. To get around this issue, Le Bars and his colleagues used a placebo — in this case, pills containing inactive ingredients. The control group received the placebo and the experimental group received the Ginkgo extract — so that all participants would have the same experience of receiving a treatment and none would know if they were receiving the Ginkgo.

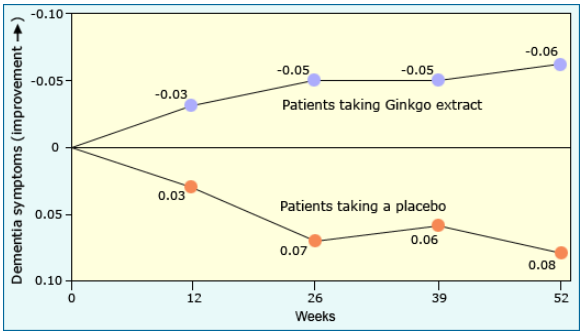
Avoiding bias: Bias can sneak into medical studies in many ways. A doctor or medical researcher who knows that a patient is receiving an experimental drug may treat or assess that patient differently without even realizing it. To avoid these biases, Le Bars used a common approach: a double-blind experimental design. This means that the patients don't know if they are receiving the experimental treatment — here accomplished by providing a placebo to one group of patients — and that the researchers don't know which patients have received the experimental treatment until after the study is over and the data have been collected. In a double-blind test, both the researchers and the participants are "blind" to the experimental treatment. Disorders like dementia add another challenge because their symptoms are difficult to evaluate objectively. How does one compare patients with symptoms that range from mood swings, to language problems, to memory loss? If researchers simply noted their impressions of symptom severity, it would be easy for bias to slip in. To increase the fairness of the assessment, Le Bars and his colleagues measured patients' symptoms using several predetermined scales — standardized tests of dementia that rely on tasks like seeing how many words on a list of ten a patient can recall. These standardized ways of measuring symptoms combined with a double-blind study design helped reduce the influence of bias in the experiment.

Distinguishing chance from real differences: To help ensure that the differences between the experimental and control groups were really due to the Ginkgo treatment and not random factors, the study enrolled a large number of participants (309) and used statistical tests to gauge the importance of the difference between the groups.

At the end of it all, the Le Bars experiment suggested that:

1. **Ginkgo extract is safe**. Those in the experimental group were no more likely to have adverse side effects or new health problems than those in the control group.

2. **Ginkgo extract can help improve dementia symptoms in those with Alzheimer disease or existing dementia**. Those in the experimental group showed fewer dementia-related symptoms than those in the control group. Since the only known, consistent difference between the groups was whether or not patients received the Ginkgo, the researchers concluded that the improved symptoms were caused by the extract.



The Le Bars study indicated that those patients who took Ginkgo extract showed improvement.

Of course, research on this topic has continued. More recent studies have cast some doubt on these conclusions. And additional research on a slightly different topic — whether taking ginkgo supplements can *prevent* the onset of dementia or Alzheimer's — has found no benefit of the extract. How can this be? The outcomes of scientific studies depend critically on the details of the way the tests are designed, but they can also be affected by random factors that cannot be controlled. As we gather additional evidence, science homes in on the most accurate hypotheses and conclusions.

Though scientists formally testing their hypotheses and theories often have complex equipment and technical resources at their disposal, the logic that goes into designing a fair test is the same — whether the test is aimed at cookie making or treating disease. The same considerations even come into play in observational studies that involve no experimental manipulation at all.

III. Fair Tests in the Fossil Record: Avoiding Extinction

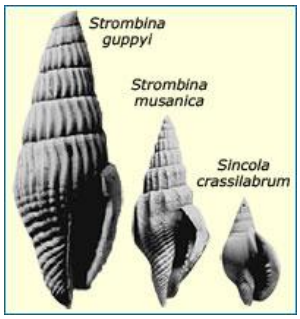
Paleontologists Ann Budd and Kenneth Johnson were interested in the factors that affect a species' odds of surviving an extinction event— specifically, whether or not small body size increases a species' chance of survival.

Ann Budd and Kenneth Johnson

To test this idea, they focused on a group of well fossilized Caribbean snails (the genus *Strombina*)

and studied many different species within this genus. Here's the test they designed:

Comparing outcomes: Using studies of the fossil record, Budd and Johnson gathered information about which of the snail species in this genus were present both before and after a mass extinction event, and which went extinct. They compared the shell size of species that survived the extinction to the shell sizes of species that went extinct during the event. If small body size upped species' chances of survival, the "survivor" group should have had smaller body sizes than the "extinct" group.

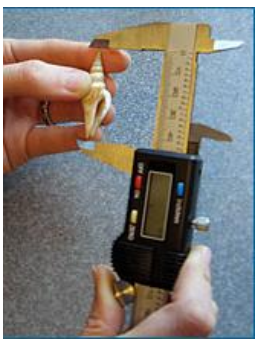


Three of the snail species used in the study. Shells shown to scale.

Controlling variables: The researchers wanted the only difference between the two samples to be whether or not the species in the sample had survived the extinction event. That meant limiting the study to a single genus of snails, so that species from one genus wouldn't be over-represented in one of the samples; studying only adult snails, so that an excess of juveniles in one of the samples would not skew their results; and figuring out the actual shell size of snails with broken shells, so that this factor wouldn't affect the size estimates for any sample.

To control variables, the researchers needed to figure out which specimens were adults. The thickness of a snail's aperture lip can indicate whether the specimen is an adult. Though the species pictured here (Strombus gigas) was not used in the Budd and Johnson study, the difference in lip thickness is very obvious. The thick-lipped adult specimen is on the left.

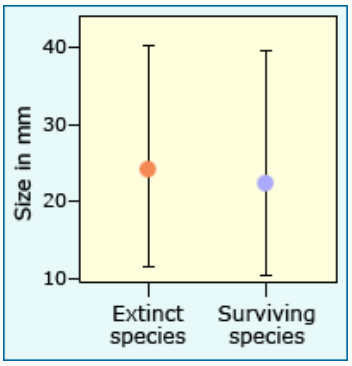
Avoiding bias: To minimize the role of subjective judgments in making the measurements, the data on snail sizes were obtained using a consistent method for measuring the shells. In addition, the researchers who collected the snail data sometimes ran into a problem: too many fossils. Some snail species were represented by so many specimens that it would have been too time consuming to measure all the adults. How did they decide which specimens to measure? If the specimens had been hand-picked for measurement, the person selecting the snails could have biased the sample toward larger or smaller snails. Instead, the researchers identified a *random*subset for measurement so that personal bias couldn't skew the data. The researchers



The researchers obtained their measurements using a consistent method. Each snail specimen was measured from the tip of the spire to the base of the aperture.

reasoned that this random subset would likely provide a representative sample of all the specimens of that species.

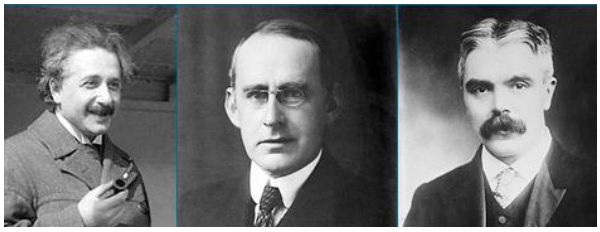
Distinguishing chance from real differences: To make sure that any differences they found were not due to random flukes, the same measurements were repeated on many, many fossils — 5099, to be exact, from 72 different species within this genus. In addition, Budd and Johnson used a statistical test to determine whether the difference they found in extinction rates was likely due to chance or to a real difference in odds of extinction. The researchers obtained their measurements using a consistent method. Each snail specimen was measured from the tip of the spire to the base of the aperture.



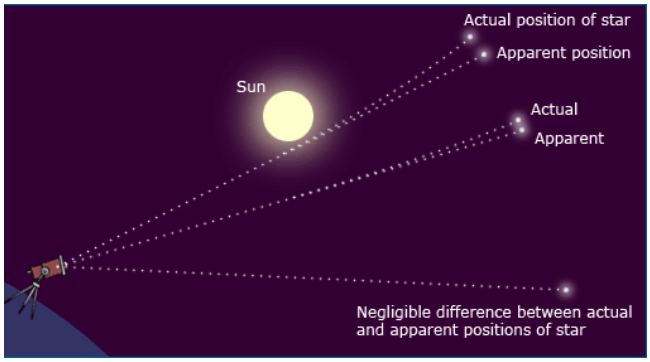
Size was not related to whether or not a species survived an extinction event. For each group of species, the mean size, maximum size, and minimum size are shown.

In the end, the test suggested that being small offers little or no protection from extinction: there was *no* significant difference in the sizes of snails that survived the mass extinction event and those that went extinct. Because Budd and Johnson designed their test so fairly, we can be confident in these results.

IV. Fair Tests in Physics: Examining Eclipses



Albert Einstein and British astronomers Arthur Eddington and Frank Dyson



If Einstein's theory of relativity was correct, then the light from stars that passed closest to the sun would show the greatest degree of "bending."

Comparing outcomes: If general relativity were at work, it would mean that starlight passing close to the sun should seem to have a bent path and that the apparent position of a star observed from Earth should shift a certain amount depending on how close to the sun the starlight passed. Thus, Eddington and Dyson set up their test to compare the apparent positions of stars during a solar eclipse (when their light passes close to the sun) to the apparent positions of the same stars at night (when their light does not pass close

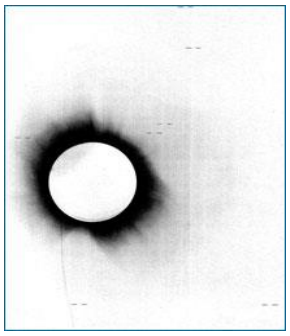
to the sun). In addition, they were able to compare the shift for stars with different positions relative to the sun. Einstein's theory led them to expect that the shift would be greatest for stars whose light passed closest to the sun.

Controlling variables: The researchers wanted the only difference between the two sets of observations of the stars' positions (eclipse vs. night time) to be how close to the sun their light was passing. That meant making the eclipse and night time observations with the same sort of telescope lenses, screening the telescopes from the wind, taking precautions to avoid distorting the film that recorded the stars positions when it was developed, and even using the same brands of photographic plates to record the positions. But of course, it's difficult to control all the variables that might influence one's observations.

The Astrographic 13" Refractor telescope at Greenwich, England. Its object glass (the lens closest to the object being viewed) was removed and used on the Sobral

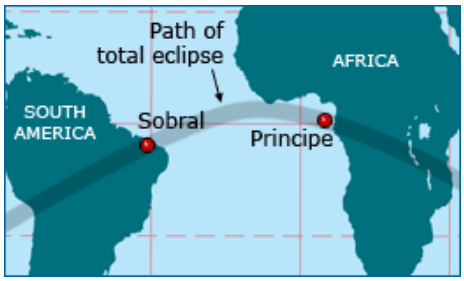
For example, the heat of the day may have caused one of the telescope mirrors to expand, distorting the images it produced during the eclipse relative to the images it produced during the night time observations. Eddington and Dyson had tried to control for this by setting up screens around the telescope to shade it during the day — but this turned out to be insufficient to control the temperature variable. In the end, they had to ignore observations made with this telescope because they provided an unreliable comparison. Shifts in apparent position could have been caused by relativistic mechanisms (as proposed by Einstein) or by mirror distortions.

Avoiding bias: To minimize the role of subjective judgments in their measurements and the bias that might accompany them, the researchers used a set procedure and fine-scale measuring devices to figure out how much the apparent star positions shifted. One set of images from a smaller telescope required a more elaborate procedure, and in this case, they had two different people take the same set of measurements on the images. Then they averaged the results together to minimize the systematic error that might have been introduced by one individual's measuring technique.

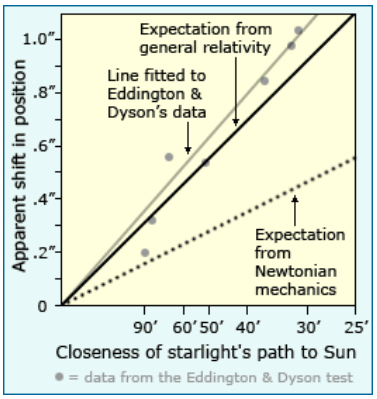


A negative of one of Eddington and Dyson's photographic plates of the eclipse with dashed lines indicating star positions. The researchers took precautions to avoid bias when measuring the positions of these stars.

Distinguishing chance from real differences: To make sure that any differences they found were not due to random flukes, Eddington and Dyson didn't rely on just one set of star measurements. Instead they took measurements from three different telescopes (two positioned in Brazil and one set up on an island off the west coast of Africa) and took many exposures with each telescope. They reasoned that they could be confident in their results if all these different images led to the same conclusions about the apparent shift in the positions of the stars — and they also wanted to hedge their bets in case the eclipse wound up being hidden by cloud cover in one of the locations. In addition, the researchers calculated the statistical error of each of their measurements in order to figure out how close their estimates were getting to the true values.



Though they had to eliminate the results from one telescope because they couldn't control the temperature well enough, Eddington and Dyson's test ended up supporting the theory of general relativity. The apparent positions of the stars shifted about the amount that Einstein's theory predicted that they would. With the development of new equipment and techniques in the following 70 years, scientists were able to more precisely measure star shift due to gravitation and found that the results even more strongly supported general relativity.



Eddington and Dyson found that the apparent radial displacement of individual stars supported Einstein's theory.

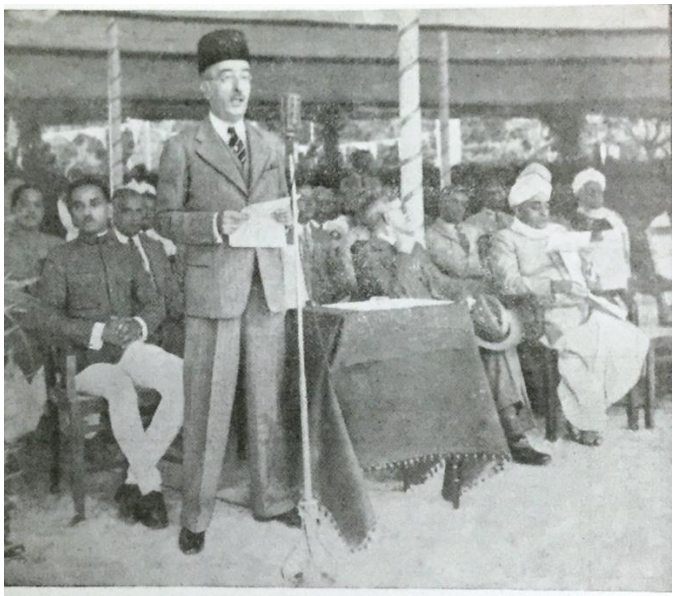
Part E –Union, Welfare, Sports, Arts & Service

- **Physical Education**
- **Student Welfare: Insurance**
- **Student Welfare: Medical Service**
- **Hostel Facility**

E1. Physical Education

Kerala University is one among the trailblazers in University sports sector in the country. Among the Universities in India, the Travancore University was the first to start a department of Physical Education. The importance of Physical Education was recognised by the founding fathers of the University. The University committee of 1923 recommended the formation of a University training corps as a part of a programme for the development of physical culture. The year 1939-40 saw the creation of a Board Physical Education to direct and guide the physical education activities of affiliated colleges. The late Col. Goda Varma Raja was the first President of the Board of Physical Education and P.I.Alexander, Director of Physical Education, its secretary. From the year 1940 onwards various activities were organised under the auspices of this department which was initially housed in the old Military Barracks compound (near the present Vikas Bhavan). The Physical Education Department had a Gymnasium looked after by an instructor in indigenous exercises. The University Gymnasium functioned till 1972 in the building adjacent to the present University Student's Centre and opposite to the G.V. Raja

Pavilion. The health/medical examination of students of the University was conducted by the Department of Physical Education. The emphasis then was on indigenous exercises, yogic exercise, free hand exercises, rowing and Cricket. These activities were organised on club basis. Medical examination of the members of the club was conducted and records maintained. Competitions were organised in Surya Namaskar and muscle control. Dr. Vineykar and Dr. Paulose were successively in charge of Yogasana since 1941 and T.K Rama Varma from thereon till 1950. In the year 1940-41, the construction of the University Stadium was started under the enthusiastic leadership of Col. G. V. Raja, P.I. Alexander, the Director of Physical Education and P.R. Parameshwara Panicker, Registrar, University of Travancore. A pavilion of cantilevered balcony and a canopy of R.C.C. Shell, a unique piece of construction, was built in the University Stadium within a short span of one year and the Department of Physical Education was shifted to the pavilion in 1963. The pavilion was named G. V. Raja pavilion by V. V. Giri, the then Governor of Kerala. Then onwards the office of the department of Physical Education has been functioning in this building.



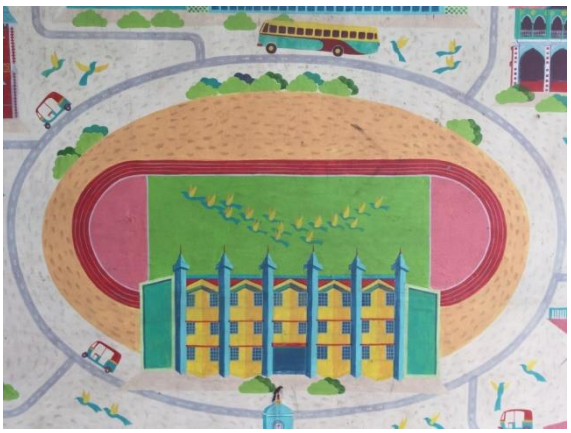
Sir M. Ismail speaking, before declaring open the 'Varsity Stadium (0849

The vision of the Physical Education department is the development and promotion of sports activities for health, educational and social benefits of student community. Accordingly, the Dept. has adopted the following mission: *(i) To provide adequate infrastructure facilities for sports and games so that students choose and participate in the events for which they have flair. To spot out and groom the sports talent. (ii) To nurture, better human relations through sports and games enjoy a perfect balance between sports performance standards and healthy lifestyle. (iii) To imbibe in the student's discipline, leadership qualities, courage and*

the sense of belonging through sports activities. (iv) To produce National & International players, by providing opportunities to develop knowledge, skills and values for the enhancement of performance in a wide range of sports through intercollegiate and inter-university forums.

Organisational Set-up

The Department is presently headed by the Director of Physical Education with an Assistant Director. The activities of the department are guided by an Advisory Committee constituted by the University with Vice-Chancellor as Chairman and the Director of Physical Education as the secretary. It consists of representatives of the



Syndicate, senior officers of the University, representatives of the University Union, Physical Education teachers of various colleges affiliated to the University, experts in the profession and outstanding sportsmen of the State as members.

Sports Infrastructure & Facilities

The University provides a wide range of top quality shared sporting and athletics facilities which will be promoted and available for use by students, colleges, clubs, individuals and other community groups. The University stadium spreads across 8 acres and 40 cents of prime property in the heart of the Trivandrum city. The University stadium is a multi-purpose stadium is one among the foremost synthetic track athletic stadiums of the country. This multi-purpose flood lighted sports venue is one of the most demanded sports venues which hosted two National games and other national and international events. The stadium has a capacity of 20000. It was the home ground of the Kerala Renji Cricket team till 1980s. In 1984, the stadium hosted India- Australia ODI in 1984 (no result) and India- West Indies ODI 1-1988 (West Indies won). In first class cricket matches legendary cricketer Sunil Gawaskar, Kapil Dev, Mohindar Amarnadh and Ravi Sashtri had played in this stadium. The stadium was also home ground of Chirag United Club in 2011-12 J- league stadium. The stadium has an eight lane athletic track, warming

up lanes wrapped inside a football field with throwing sectors, jumping pits, Volleyball court and Basketball court outside, with lush green shade trees around the pavilion.

A physical fitness centre is operational at the University stadium in order to gear up for extensive physical activities and sports conditioning workout in the gymnasium. The centre has almost all the requisite instruments and equipment required for exercising.

Greenfield International Stadium, Kariavattom

Green field stadium is a Multi-Purpose Stadium and an exceptional facility for international games of cricket and football. The playing arena in the stadium has been constructed in line with FIFA regulations and International Cricket Council norms. This multi-functional stadium is capable of hosting international cricket and football matches as well as cultural and entertainment events. It also accommodates facilities for indoor sports like Table Tennis, Basketball, Badminton etc., a gymnasium and spa, a clubhouse with five-star facilities, tennis court, Olympic size swimming pool, open convention cum trade cum exhibition centre, retail outlets, food courts, club facilities, car parking, etc. It has a seating capacity for 55,000 spectators. It is the first stadium in the country made on DBOT (Design-Build-Operate and Transfer) basis. The land has been given on lease by the University for 15 years after which the stadium will be handed over to the University.

Other Arenas

Apart from the aforesaid facilities, the University has a roofed Basketball court in its main campus, adjacent to the senate hall. Incidentally, this court is said to have been the first Tennis Court in Trivandrum. A mini stadium is also there at Kariavattom campus.

E2. Student Welfare: Insurance

Abstract of U.O.s

UNIVERSITY OF KERALA

Abstract

Students' Group Personal Accident Insurance Scheme with a medical extension, covering medical expenses arising due to accidents up to Rs.25,000/- and death claim up to Rs.1,00,000/- to regular students under the University of Kerala – Premium @ Rs.25/- per student -- Sanctioned – Orders issued.

ADMINISTRATION 'D.I' SECTION

No.Ad.D.I.DSS/SGPAIS/ME/2008-09 Thiruvananthapuram, Dated 25.10.2008

UNIVERSITY OF KERALA

Abstract

Department of Student Service-Students Group Personal Accident Insurance Scheme Enhancement of Death Claim to Rs. 2 Lakhs to death happening wef 01.01.2014-Sanctioned Orders-Issued.

ADMINISTRATION 'D.I' SECTION

No. Ad. D1/DSS/SGPAIS//ME/2008-09 Thiruvananthapuram Dated: 22.03.2014

UNIVERSITY OF KERALA

Abstract

Department of Student Services- Student Group Personal Accident Insurance Scheme-Enhancement of Death Claim to Rs. 3 lKahs- to daths happening wef 01.07.2016 – Sanctioned-Orders Issued.

ADMINISTRATION 'D.I' SECTION

No.Ad. D.I/DSS/SGPAIS/Enh./2016 Thiruvananthapuram, Dated: 10.10.2016

E3. Student Welfare: Medical Service

University Health Centre acts as a hub for all health related activities, with a focus for the uplift of physical, mental and environmental health of the campus community. The centre comprises the following staff members.

- Medical officer
- Health Information Officer
- Clinical Psychologist
- Nurse
- Lab Technician
- Radiographer

Any student of member of the campus community can approach the centre for all their health issues. The clinical psychologist is available for interaction especially for the management of stress related issues of students who come from different social and economic strata. The Health Information Officer serves as a bridge between the centre and the beneficiary campus community. Frequent interaction with the students is being conducted by the centre at various departments and hostels. During these interactions, all issues related to health of the campus community are given particular importance. The centre also has charted out a novel programme of reaching to every student regularly, by frequent interactions to all departments.

During these interactions, students can share all issues pertaining to their health and clear off their doubts about the same. So also, during these interactions, special care will be given for the practice of simple measures for the prevention of diseases, especially for the maintenance of a healthy environment to keep off many common but dangerous diseases.

A health centre works in the Karyavattom campus with basic amneties and is open for free of charge to all students. The following personal are available for consultation.

(1) **Medical Officer** who possess both Allopathic and Ayurveda medical post graduate Degrees (Mobile No. **8547631691)**

(2) **Health Information Officer**. (Mobile No. **8547607433**)

(3) **Clinical Psychologist** on **Mondays** and **Fridays** each week between **12 PM to 2 PM (**Mobile No. **9446100164**)

Office No: 0471-2308976 E mail ID: rmouhc @gmail.com

E4.Hostel Facility

Researcher's Hostel for Women

Researchers' Hostel for Men

University of Kerala provides hostel facility to residential research students (both - men and women) at MPhil/Research level, at nominal rates.

1. *University Researchers Hostel for Women, Kariavattom (Capacity 129)*
2. *Researcher's Hostel for Men, Kariavattom (Capacity 83)*
3. *University Womens Hostel, Thycaud*(Capacity 354)*

** Accommodates students from affiliated colleges and University Depts*

The Hostels in Karyavattom Campus together provide accommodation for 670 students and researchers and 25 Teachers. All hostels run in full capacity. Hostel demand ratio is in Kariyavattom Campus is 0.69. Students living at least 40 Km away from the campus may only apply.

Part F: Our Campus

- **Flying jewels & feathered friends of our campus**
- **Geology of our campus locality**
- **Campus: The environmental settings**
- **Snapshots of history of our campus locality**


UNIVERSITY
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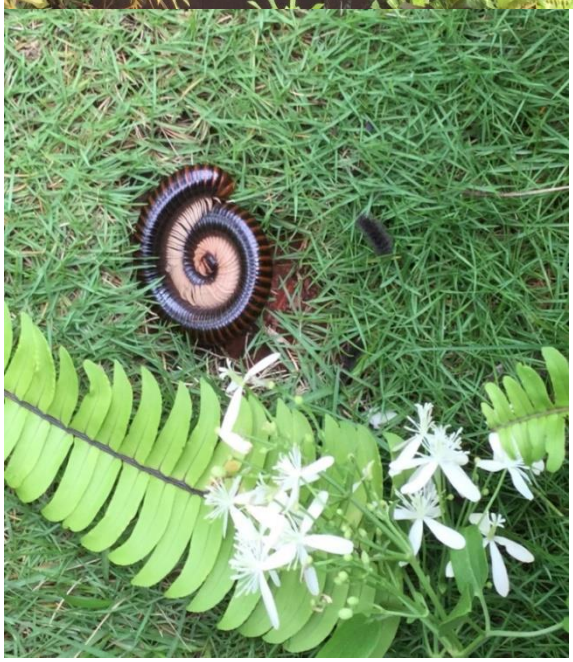
KERALA
KARIAVATTOM



F1: The Flying Jewels & Feathered Friends of our Campus[14]

The Kerala University Campus at Kariavattom is an urban area close to the Technopark and is famous for its biodiversity owing to the semi forest type vegetation and climate. The area is about 16km north of Thiruvananthapuram city, distributed on either side of the NH 66 connecting Thiruvananthapuram and Kollam. The elevation is about 57m from the mean sea level. The buildings in the campus are traversed by gardens, trees, bushes and grass land. The Department of Zoology has been monitoring and documenting the biodiversity, particularly of animals of the campus, from 2014. The study of diversity of butterflies and birds are completed and the survey on reptiles, ants and spiders ongoing.

Butterflies in Karyavattom Campus

A total of 110 species of butterflies belonging to five families have been identified from the Kerala University Campus, including three species that are endemic to the Western Ghats and twenty one species protected under various schedules of the Indian Wildlife Protection Act, 1972. The total number of butterflies was recorded highest in the month of June (490 individuals) and lowest in the month of April (126 individuals). The monthly abundance of each butterfly families showed higher values in the month of May and June when compared to March and April. Out of 110 species of butterflies recorded from the Campus, 21 species came under the Wild Life Protection Act. The campus provides favourable ecological factors and habitat for butterflies.

Birds in Karyavattom Campus

62 species of birds belonging to 14 orders and 32 families have been spotted from Kariavattom campus; Among orders, Passeriforms and among species, *Crovus splendens* dominate. *Aviceda leuphotes, Spizaetus cirrhatus, Cyornis rubeculoides, Terpsiphone paradise, Streptopelia chinensis, Chalcophaps indica, Tyto alba* and *Pavo cristatus* were the uncommon species and the most interesting sightings from the campus. The South-west region of the campus supported maximum number of birds. The birds are evenly distributed in Hymavathi pond and associated wetlands and Eastern side of campus supported the least. The abundance and richness of birds is seen to increase along with the abundance of floral species and habitat diversity. The avian fauna of Kariavattom campus are sufficiently rich in species diversity. The patches of undisturbed areas, mixed vegetation and the presence of wetlands in the campus could be the factors which support the bird diversity.

[14] Contributed by Dr G Prasad, Dept of Zoology

The increasing urbanization affects biological diversity because it radically modifies the ecology of landscapes and contributes to habitat alteration. The Kerala University Campus at Karaivattom is expanding with the addition of new infrastructures and it is the duty of the University community to conserve the existing biodiversity of the campus since it consists of many rare and endemic species of both butterflies and birds. This green urban ecosystem is important for the human community interacting with the campus every day. An integrated design approach to promote green structures according to contemporary social needs and grounded on a deep understanding of urban ecosystems is required. Such approaches can let humans, plants and animals share public spaces with least possible conflict.

Birds and Butterflies: Birds are the most diverse and fascinating vertebrates that dwell in almost all habitats, play a major role in providing different ecosystem services and also serve as good bio indicators. The richness or abundance of avifauna is directly related to the health of the ecosystem. The avifaunal diversity assessment has become an important tool in biodiversity conservation and for identifying conservation areas. Butterflies and birds are good biological indicators of habitat quality as well as general environmental health, as many species are strictly seasonal and prefer only particular set of habitats. Butterflies and birds may react to disturbances and changes in habitat and act as ecological indicators. They may get severely affected by the environmental variations and changes in the forest structure, as they are closely dependent on plants. Thus minor changes in their habitat may lead to either migration or local extinction. The change in land use pattern may lead to landscape changes that can reflect into changes in butterfly and bird diversity and distribution. Kerala has rich and diverse butterfly and fauna because of the availability of wide range of habitats.

Butterflies have always fascinated human imagination and creativity. Butterflies are commonly referred to as "insects of the sun" and "fluttering jewels of nature", with their eye catching colour and delicate charisma. The sight of a languidly fluttering butterfly with its intricately patterned wings is cathartic to people. People from all walks of life enjoy these beautiful winged jewels. Due to their beauty, dramatic transformation during their life cycle and their interesting phenomena of mimicry and migration, these fascinating creatures always acquire a niche in prose and poetry. They are the most studied group of insects. Interest in Butterflies is probably next only to birds in their universal popularity. The word "*butterfly*" has curious origins. Butterflies get their name from the yellow Brimstone butterfly of Europe. The Russian call them "Babochka", meaning little soul. Ancient civilizations have depicted butterflies as little souls or angels and many early civilizations have recorded them in prehistoric caves and in pottery and fresco.

F2. Geology of our Campus Locality[15]

The University campus at Kariavattom falls in the Survey of India toposheet No.58 D/14 with the co-ordinates E 76^{0}32′30′′ and N 8^{0}34′00′′. The total area of Kariavattom campus is around 400 acres. The campus is a rugged terrain with an altitude ranging from 15 to 48 m amsl. In general, the area is covered by fairly steep hillocks with narrow valleys in the western side. The valley portion is sloping towards south and southwest. This area is drained by Kolathur stream and its tributaries, flowing from north to south and northeast to southwest directions. Two prominent valleys exist in the campus , one located on the western side of the campus trending N-S, near Haimavathikulam and second one behind the botany building and near the inetrnationalstadium. These valleys are the channel ways for the surface and groundwater discharge from the campus. The area enjoys a tropical monsoon climate and the rainfall is fairly well distributed. The area receives an average rainfall of 1826 mm. The rainfall is distributed throughout the year the maximum rainy days during June and minimum is during the months of January and February. Temperature of the campus ranges from 39^o (April-May) to 20^o (December) with a humidity of 60- 90%. The potential evapotranspiration rate is 64 mm/month and average wind speed is 4.3 km/hr. The dominant soil of the area is lateritic and clay loam. The low-lying areas are covered with alluvium mixed with clay. The area is underlined by laterites, sandstones and clays belonging to Warkali formation. The sedimentary formations are observed in the dug well at Kariavattom Campus are mainly composed of sandstones, thick Kaolinite clay, clayey sandstones and carbonaceous clay (Photo 1). The Kariavattom area is comprised of sedimentary formation of Tertiary age (interval of geologic time lasting from approximately 23 million to 2.6 million years ago) over a basement of metamorphic crystalline rock of Pre-Cambrian age (>540 million years). The sedimentary formation consists of ferruginous sandstone, pale red clay, white clay, carbonaceous clay lignite seam and clayey sand. The basement rock is garnetiferous quartzo-feldspathic gneiss (leptynite) and khondalite.

The top portions of the sedimentary sequence are lateritised and form a blanket. The sedimentary formation is known as Warkali (Varkala) formation. Varkala is a coastal town situated about 55 km MW of Trivandrum. The

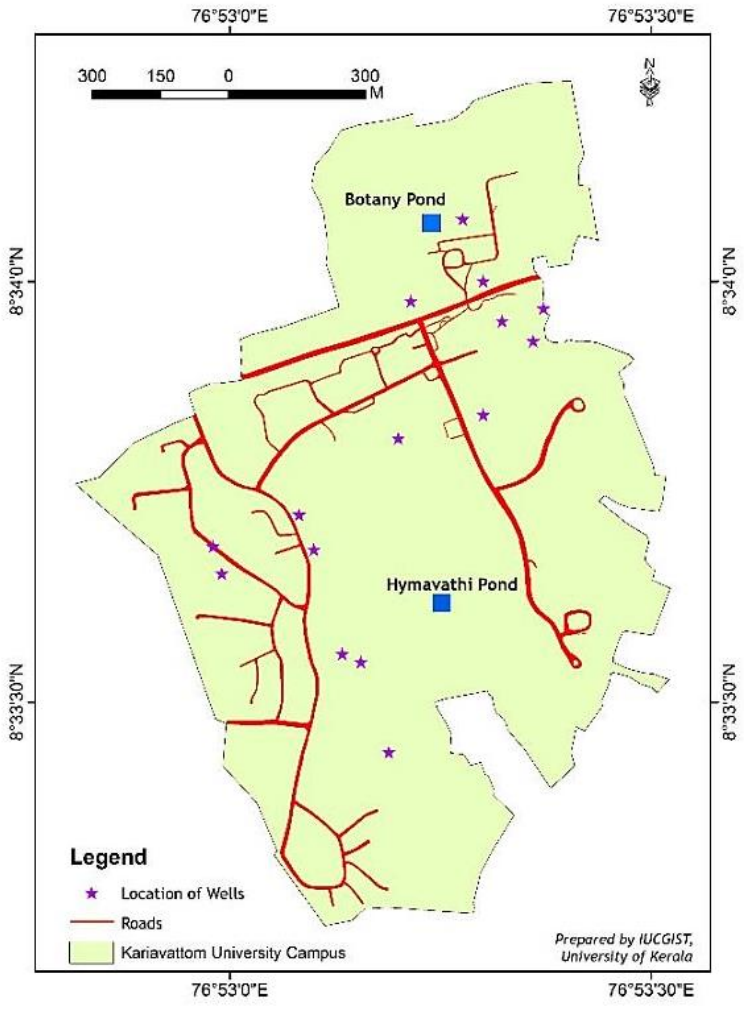
[15] Contributed by Dr E Shaji, Dept of Geology

most important attraction of the place is the beach and the presence of beautiful wave-cut cliffs. Varkala is the only place in southern Kerala where such cliffs are found adjacent to the Arabian Sea. This cliff formation is a unique geological feature on the otherwise flat Kerala coast, and is known among geologists as Warkali Formation. There are numerous water spouts and spas on the sides of these cliffs. The Geological Survey of India is in the process of getting it declared as a 'geological monument'. Varkala will soon enter into the UNESCO's world map of geoheritage sites and the global geotourism will be benefitted.
Picture shows the subsurface lithology of campus.

F3. Campus: The Environmental Settings[16]

The Kerala University Campus at Karyavattom currently hosting 36 research and teaching departments and associated institutions is spread over an area of about 350 acres. This extensive landholding has immense ecological and ecosystem service potentials by way of its intrinsic biodiversity, watershed value and as a research site for basic taxonomy, ecological and landuse/land capability studies.

The campus itself is a micro watershed, supported by a 'vayal' spreading over 0.2 sq.km., located near the southeastern border, which plays a critical role in ensuring water security of the region. In addition two larger perennial ponds are located inside the campus, Pullenkonam Chira or Haimavathy pond located near the Department of Aquatic Biology and Fisheries and Kundettukonam Chira, near the Botany department. The former derived its name 'Hymavathi' in the recent past, with a mythical story of a girl who was drowned in the pond, which offers platform for a series of associated 'ghost' stories! These ponds could have been the drinking water sources for the earlier human settlers in the area and the 'vayal' would have been the region of rice cultivation in the past before the land was acquired by the government. In addition, the Echilatt Kulam located in the mid-eastern border of the campus is now renovated and used by the public for various purposes.



The flora of the campus is represented by more than 600 species including medicinal plants and rare species associated with a sacred grove in the northern campus. Once known as 'Vaidyan Kunnu' the campus and adjoining landscape hosted rare medicinal plants and the

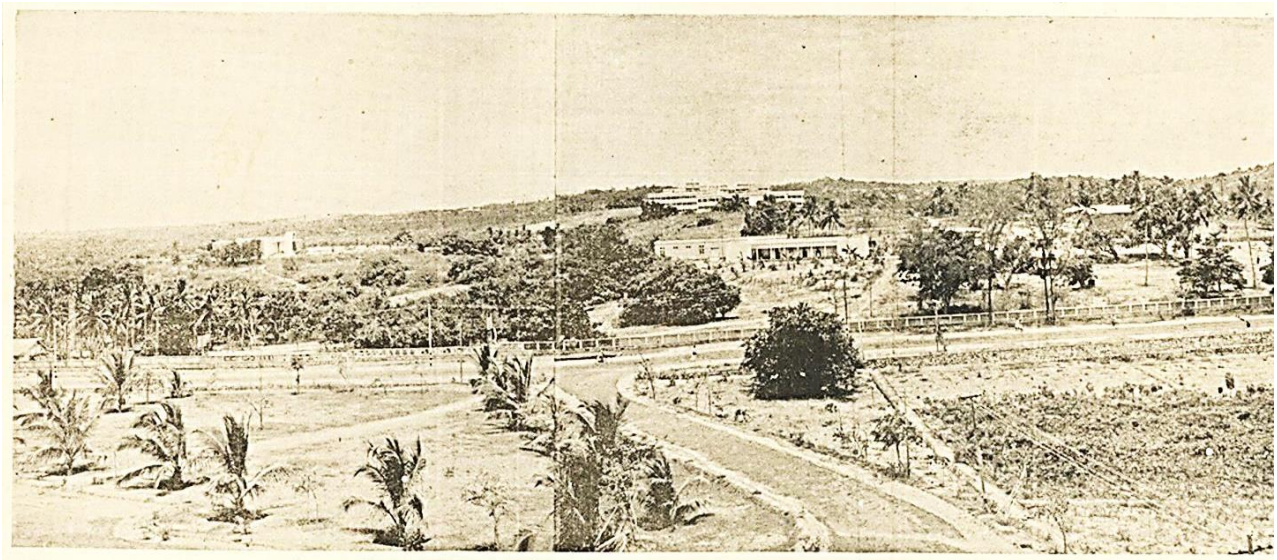
[16] Contributed by Prof A Bijukumar, Dept of Aquatic Biology & Fisheries

degradation of the system was contributed primarily through afforestation activities with the exotic Acasia (*Acacia auriculiformis*) as part of the social forestry programme. The new initiatives to replace the exotic species with indigenous tress envisages to qualitatively improve the environmental settings. The two large wells of about 300,000 litre capacity installed near the major ponds currently would serve as a major water source of the campus.

The degraded forests inside the campus offer major roosting grounds for the Indian flying fox (*Pteropus giganteus*) and a good colony of Indian grey mongoose (*Herpestes edwardsii*). The avian diversity recorded from the campus include 62 species of birds (including the rare spotting of Black Baza, *Aviceda leuphotes*), 20 species of reptiles, 8 species of amphibians (including the Malabar gliding frog, *Rhacophorus malabaricus*) and 12 species of fishes. The campus also host 105 species of butterflies belonging to the families Nymphalidae (40 species), Lycaenidae (23 species), Hesperiidae (18 species), Pieridae (13 species) and Papilionidae (11 species), which also includes 21 species that come under the protection category as per the Indian Wild Life protection Act 1972 and 9 species endemic to Western Ghats.

F4. Snapshots of history of our Campus Locality[17]

Karyavattom, second home to the University academic community, was once in the outskirts of Trivandrum city. As the wheels of development rolled, Kariyavattom and adjacent Kazhakuttom became a part of the techno city or satellite city of Trivandrum. Like all new cities that appear like a flash mob, most of its inhabitants are unaware of the local history and are fast creating a new history for the future.



A BIRD'S EYE VIEW OF THE KARIAVATTOM CAMPUS

Is Kariavattom a place where people sat in a 'vattom'(round) to chat ('Kaaryam parayan')?. Totally unlikely. The name 'Kariavattom' arguably originates from the word "Kaaryakkar", a reference to temple employees. Personnel associated with Kazhakkoottam Mahadeva temple/Thrippadapuram Temple near the campus may have created settlements near the temple. The 'karyam' in Karyavattom is seen embedded in other nearby place names also such as "Sreekaaryam" and "Kariyam". (Sreekaaryakkaran = the superintendent of a temple –Herman Gundert). There is also an argument that "Kari" refers to farmlands as in Ramankari in Kuttanad.

'Kazhakkoottam' may have originated from "Kazhaka Koottam", *kazhakam* being a reference to temple authorities (A temple chiefly considered in its political bearing- Herman Gundert). Kazhakkoottam temple is ancient and lends credibility to the above arguments. There are other theories for the place name, "Kazha" could be timber used for construction or ship building. In Mathiliakam Records (Churuna No. 2490, Ola no. 410) of 1770 AD, the place is mentioned as "Kazhai Koottam". Dense plantation (koottam) of kazha could have been there in the place. One of the traditional houses in the area (near

[17] Contributed by Prof. Achuthsankar S. Nair, Dept. of Computational Biology& Bioinformatics

Arasinmoodu) bears the name 'Kootta thengu". Yet another explanation is that there could have been a "Kazhaki" temple (village godess) during sangam period. V.V.K Valath opines that "Kazhaki Koottam", gathering in front of 'Kazhaki', could have become Kazhakkoottam. There is an Amman shrine near the Kazhakuttom shiva temple to lend credibility to this argument. Naduvattam Gopala Krishnan (who hails from Naduvattom, but is settled in Karyavattom) mentions that 'Shuka Sandesham', a work of 13th century, refers to travel from Trivandrum to Quilon through a place full of 'Kazhukan' (eagles). He opines it could be 'Kazhuka Koottam' that became Kazhakkoottam. (The travel from Trivandrum to Quilon could also have been through the sea-side instead of the national highway we see now). There is then the belief that the temple was consecrated by Kalakkode Maharshi (who lived near to Kumizh Theertham, a pond a few kilometers away from the eastern part of the temple, extant even today), and the place was named after him as Kalakkode. That Kalakkode could transform to Kazhakkoottam is not tenable. Also, if we go by modern style, the name 'Kalakkode Maharshi' can be argued as carrying a place name itself. Among all explanations, one tracing Kazhakuttom to '*Kazhakam*' of Mahadeva temple seems most tenable.

Ward and Conner (1818) refer to Kazhakkoottam temple along with the major temples in Trivandrum. He also says *Cullicoottum is a populous village on the high road 7 ½ miles N.W. by ½ W of Trivandrum; a pagoda stands on the North of the road, the roof covered with plates of brass, having a gilded minaret on the top. An agarum lies to the South of it dedicated to the Goddess Mahadavee, where a festival is annually celebrated and attended by the Rajah, who has a palace on the bank of the reservoir East of it "* . Dept. of History of University of Kerala has done studies on the origin of Mahadeva temple in Kazhakkoottam. The M.A. dissertation by Jathin jith (2004) dates its origin as 800-1004.

Area in and around Kariyavattom and Kazhakuttom are believed to have been Buddhist/Jain vihars. Many place names are cited as the first evidence. 'Pothencode' is claimed to have been 'Budhen code'. So is 'Puthenthope'. Place name such as: 'Ambalathinkra' and 'Kallampalli' are also counted Budhist by many due to the words 'Ambalm' and 'Palli' in them. The Kazhakuttom Mahadava temple is itself argued as a Budha vihar in older times. It is said that the sastha shrine bordering the N.H, which is curiously kept outside the main compound of the temple, could have been the original Budha idol in the main temple. The Madavoor Para rock temple near Chenkottukonam

(which, by the way, is *not* related to Kottukonam Mangoes), is also traced back to Jain/Buddhist origins.

Dated back to 850 AD, the Madavaoorpara Temple has a Peedom (seat) and Siva Linga, crved in the rock with inner perambulatory space. Two images, one of Murug and the other of Ganpathy are also carved on the walls. There is a Vattezhuth inscription in the temple. The temple and the Sivalinga are carved in stone. The height of Madvaoorpara is about 1800 feet and the temple is situated 50 meters above ground level. Dr Shaji of Dept of Geology opines that the Madavoor para is made of metamorphic rocks (Khondalite) formed approximately 2000 million years ago. The rock was formed approximately 18 km down the earth and subsequently uplifted to the surface by tectonic forces. The rock has got a particular foliation (alignment). The alignment helped people to make caves.

Kazhakkoottam is famous as home to one of the 8 petty chieftains who formed a syndicate to capture power from Marthanda Varma about 285 years ago. Kazhakkoottathu Pillai was one of the Ettuveettil Pillamaar who revolted against the king in waiting, Marthandavarma, and ended up losers. The pond that you see on the right as you enter the bye-pass road from Kazhahoottam junction is argued as the spot where house of Kazhakootathu Pillai was. It was razed down and a pond was dug (puthukkulam), bringing up the phrase "kudumbam kulam thonduka". The females of this family were sold to fishermen to the nearby coastal areas i.e., Puthenthope. Valiathura, Puthukuirichi. In repentance to his actions he constructed a small Shrine of Vishnu near to the pond locally known as Kulangara Sri Krishan Swami temple and also built a palace known as Kulangara Kottaram (Kulangara Palace).

Venad historian Sivasankaran Nair gives the name of Kazhakkoottam Pillai, who was killed by Marthanda Varma as 'Kazhakkoottathu Kanakku Raman Iswaran' and says that his family has more than two hundred years of history as the honest servants of Venad rulers. Sivasankaran Nair quotes Mathilakam Churna (904-930), ola 34-38), ME 914, which describes the trial of the Etuveettilpillais. Marthanda Varma is seen asking

"Ningalkku ithinvannam okkeyum thonnuvan sangathi enthanu", "Ithinvannam thonnathakkavannam naam ningalude nere enthu cheithu?" (What is the reason for you to think like this, what did I do to you making you think like this? [ie., to conspire to kill me])?

Marthanda Varma's fame is also related to his victory over the Dutch at Kolachel. Interestingly Kazhakuttom has a Dutch connection even today. One of the first companies in Technopark manages the traffic in the Duch streets, sitting far away in Kazhakuttom, place of attention of its 3-centurhy old enemy.

Before the first (unreliable) census was taken in Travancore during 1830s, Ward and Conner who had completed a survey of Travancore in 1820s, gives glimpses of population in Travancore,. These may possibly be estimates rather than data arrived at through enumeration. This data indicate that Kazhakuttom had a population of around 2500 only in 1820. There were about 1000 houses, about 250 cattles, 250 reservioirs or wells, 18 religious buildings and 4 public buildings. While Kulathoor and Pallippuram had around 25 toddy/arrack shops each, in Kazhakuttom they was conspicuously absent. The demography transformed gradually and by 1960s when the area started to develop with the opening of the Kariyavattom Campus. The establishment of the Campus saw major re-settlement (Sobha who now does casual work in the campus was born in the campus. She remembers that they were evicted in a police vehicle and put up in 5 cent land in Kazhakuttom).

Ettuveetil Pillai is of course of no contemporary interest. There are other historic personalities in and around Kazhakkoottam who have made a mark in the modern times. Saint and social reformer Sree Narayana Guru hails from Chempazhanthi about 5 km South of Kazhakkoottam. The 'Vayalvaram' house where he was born in still preserved intact. Sreenarayana Guru has other presence in the area. Guru conscreated a Shiva at Kolathukara near Kazhakuttom following the revolutionary consecration at Aruvippuram. He also composed a hymn (Kolatheesava sthavam). He also stayed in the temple and did some writings. The place where he stayed is new memorial building housing his furniture. He blessed a library started in 1920 by his disciples Sasthavilakam Kesavan and Venth Vilakom Narayan. In 1925, the saint visited the library which now exists in a modern building as "Kulathoor Sreenayan Memorial Library".

In the road to north, in Thonnakkal, we can find the home of renaissance poet Kumaran Asan, who was also close associate of Narayana Guru. Asan chose to settle down in Thonnakkal towards the end of his life. He also established Saradalym Book Depot. He lived only a couple of years in this place. Thonnakkal Devi temple is famous for hosting

the famous musician Shadkala Govinda Marar almost two centuries ago. A few kilometers ahead of Thonnakkkal is Pallippuram where the CRPF camp is situated and the Technocity is coming up. Pallipuram is famous as home to Barrister G.P. Pillai,(born 26 February 1864, died 21 October 1903) a mentor figure to Mahatama Gandhi and is often reckoned as father of political agitation in Travancore. There are many prominent people who do not find mention in the chronicle of the history. Boniface, a member of the fisherman community of St. Andrews area, was an INA hero who collaborated with Vakkom Abdul Khader in freedom struggle.

There were two wetlands in the campus, one is south and one is north, both served by perennial ponds, both abandoned now. In 1968s and 70s, the University had a farm officer and loads of rice were sold each year after harvest. There is no doubt that the whole area was a vast farm land, remains of which can be seen today directly or through place names. The farm area begins form Palippuram and was named 'Pallippuram Ela', said to be second only to Kuttanad. The farm land ran right up to the city of Trivandrum. Ward and Conner says: *"Pulleapooram, an extensive village on the high road 9 miles N. W by N.0.5 of Trivandrum on the skirts of an extensive valley of paddy, is divided by narrow lanes; the houses in compounds stocked with coconut trees, about the center is a mosque. A road goes off from it to Anjengo. ½ At the upper end of the village on the West of the high road is a Vishnu pagoda and chuttram. There is a Agrum for Brahmins also at Cuddanancolum"*. About Kazhakoottam, Ward and Conner mentions "*On the N.E. is a spring issuing from the declivity of an eminence, discharges itself in a cistern of about 12 feet square, this water descends through a subterranean channel for about forty five feet, into another basin so contrived as to retain from five to six feet water throughout the year, the superabundant waters running out at two spouts, into a field".*

It was naturally served by many ponds and canals, many of which today face decay. The large "Ana Thazhum Chira" near Pallippuram, is an instance. You can see the very rare 'Kandal Cher', semi fossilized kandal waste which emits smoke (sulphur, according to some scientists). Elephants are said to be fond of sulphur springs and the name "Ana Thazhum Chira" assumes significance. Other important water bodies are Chenkottukonam Chira, Thudathil Chira, Mangattukonam Chira, Chanthavila Chira, Sasthavattom Chira, Ulloorkonam Chira, Madavoorpara, Thenguvila Kulam, Pothencode, Malayakonam Chira, Chittikkara Paramada, Ayiroorppara (Madathil Kulangara Chira) Thengnamcode Chira and Thettiyar. Thettiyar

runs through Andoorkonam, Pothencode & Kazhakuttom Panchayath areas and releases itself into Veli Kayal, before passing through all three phase of technopark. The Kazhakoottam beach is a few Kilometers from the campus. There are ponds in and around the Karyavattom campus. Pullekonam Chira is South Campus and Kundettukonam Chira in North Campus. In the vicinity of the campus are "Echilott Kulam" and "Kottoor Kolla", the later said to be formed during Monsoon flash flood.

1961 report of the University mentions that the Trivandrum Centre is "about 345 acres of land between 8th and 9th mile stones on the Trivandrum – Quilon Road". It was during the tenure of the Pattom Thanupillai, as Chief Minister of Kerala, that the land was acquired. The annual report for 1965 puts the total area of acquired land at 512 acres and a sum of 31 lakh rupees was paid as compensation to individuals. The campus falls in the panchayats of Kazhakkootam, Sreekariam and Attipra. The campus was inaugurated by Dr. S. Radhakrishnan on 31 September 1963 and the marble plaque remains abandoned even today. First buildings to come up were Engineering Unit, Gandhi Bhavan, Social Science Block and the Botany Block. The original campus plan was designed by Piran Amid Davis, a Madras based architect. Later a new master plan was designed by J.C. Alexander. Total acquired area now stands at 600 acres, of which 50 acres were given to LNCPE, 50 acres to technopark, 50 cents to Telephone exchange and a few cents were given on lease to Madrasa and Road Research Institute.

The campus also had the myth of its own, the spirit of Hymavathy, which refuses to go away! Not many know that Hymavathy is a mere imagination of a former student of the Malayalam department who wrote a novel in which his imaginary character Hymavathy commits suicide.

കാര്യവട്ടം

ഡോ. ചേരാവള്ളി ശശി

പുഴകൾ വഴികൾ കടന്നുനമ്മൾ
പുതിയനെല്പാടവും തേടിയെത്തി.
നിധിവിളയിച്ചതു കൊയ്തുകൂട്ടി
ഫലമുണ്ടു ജീവിതം സ്വർഗ്ഗമാക്കാൻ

സ്വപ്നങ്ങൾ മോഹങ്ങൾ പൂട്ടിവെച്ച
പെട്ടിയൊന്നൊന്നായിറക്കിവെച്ചു
ദുഃഖങ്ങൾ, മിഥ്യകൾ നീക്കിവെച്ചു.
ചിത്തം മിനുക്കിത്തുടച്ചുവെച്ചു.
വ്യത്യസ്തസംസ്കാരശീലമൊക്കെ
അത്രയ്ക്കകലേയ്ക്കെറിഞ്ഞുടച്ചു.
ഒരുമിച്ചു കൂടിനാം പിന്നെയെത്ര
യരുമപ്രതീക്ഷയ്ക്കു തിരിതെളിച്ചു

ഒരുമയുണ്ടെങ്കിലും ജീവിതത്തെ
പലവഴികണ്ടു പഠിച്ചറിയാൻ
തലയും മനവും കടഞ്ഞിടുന്നോ-
രിവരെ മറന്നു ഋതുക്കളെല്ലാം!

കലയും കവിതയും തേടിവന്നോർ
ഉലകിന്നടിവേർ ചികഞ്ഞിടുന്നോർ
അണുമുതൽ അംബരാന്തം വരേയ്ക്കും
കതിർവെളിച്ചങ്ങൾ വിരഞ്ഞിടുന്നോർ
ഗണിതവും തത്ത്വവും പേറിവന്നോർ
ഭരണവും നിയമവും പരിചയിച്ചോർ

ഇവരെത്രവേഗം മടുത്തുപോയി
നെടുവീർപ്പിൽ നീറിക്കരുത്തുപോയി
പലപാടുപിന്നെപ്പുലമ്പിടുന്നു.

പറുദീസ ഞങ്ങൾക്കു നഷ്ടമായി
നിധി തേടിയെത്തിയോരല്ലെ നമ്മൾ ?
വിളവെങ്ങ് ? കനവെങ്ങ് ? കനിവുമെങ്ങ് ...?

അടിമണൽ കാലം കവർന്നെടുത്തേ
മുടിയിൽ ഋതുക്കളും കൂടുവെച്ചേ.
അഭയം ഇരന്നു നാമുഴറിനിന്നേ.
ഭയവും കരളിൽ തെഴുത്തുവന്നേ

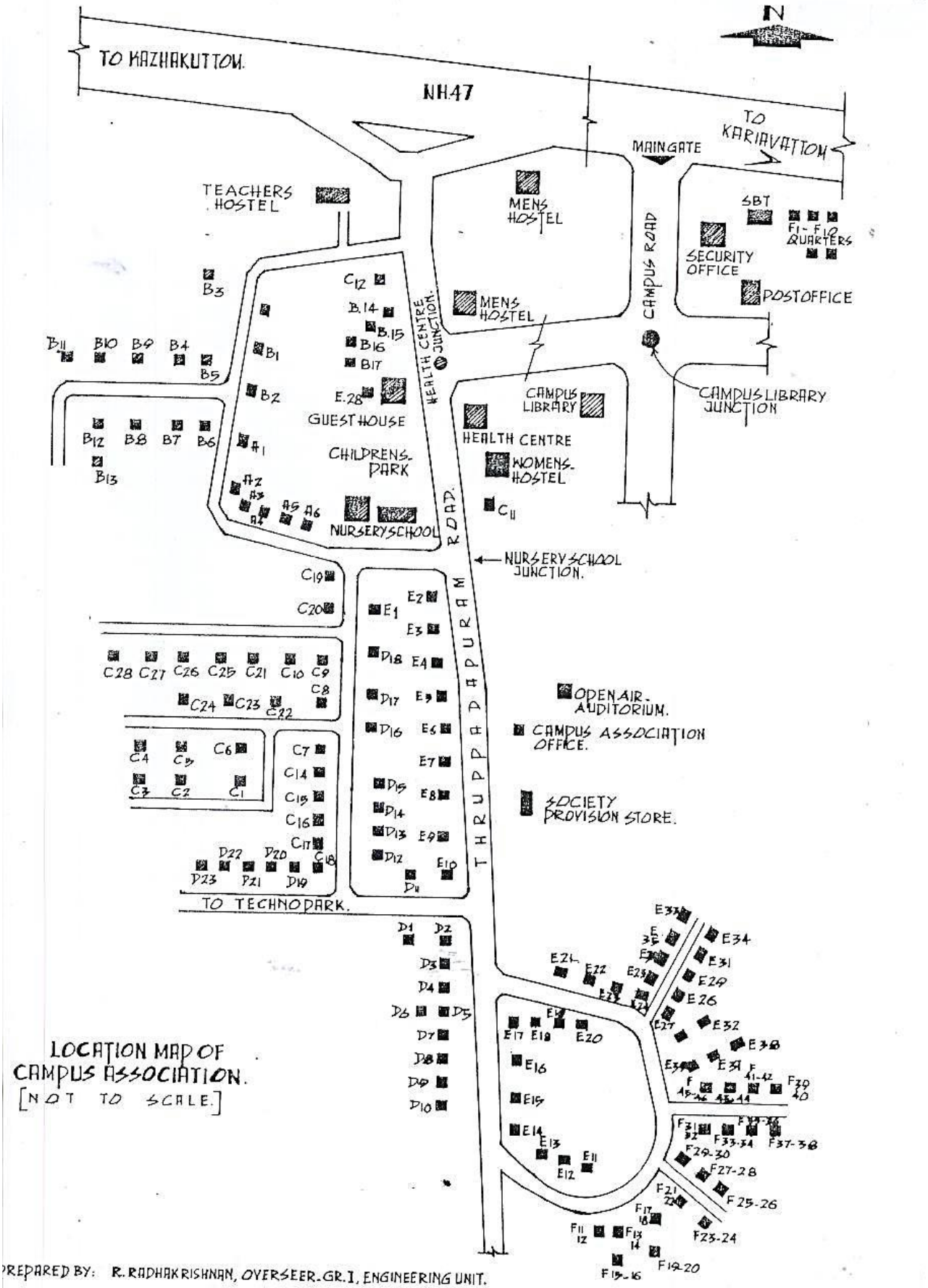
ഇവിടം നിശ്ശബ്ദമീ വിജനതീരം.
മരവിച്ച പ്രേതസങ്കേത പൂരം.
കുഴിയും കുളവും കരിമ്പനയും
കുടിയൊഴിഞ്ഞോരുടെ മുടിയുമെല്ലും
ചുടലപ്പിശാചിന്റെ നിലവിളിയും
കരിമൂർഖനാടുന്ന നടവഴിയും
ഇവിടെ നിന്നെങ്ങനെ നിധിയെടുക്കും
ഇവിടെ നാമെങ്ങനെ പുലരിതീർക്കും
ഒടുവിലാരോചൊന്നു, കൂട്ടരേനാം
മടിപിടിയ്ക്കാതെ വിതച്ചുകൊള്ളൂ.
കാര്യങ്ങൾ നേർവഴിയ്ക്കെത്തുമല്ലേൽ
കാര്യവട്ടത്തിനെന്തർത്ഥമുള്ളൂ ?

UNIVERSITY OF KERALA

MAP OF PALAYAM CAMPUS (16.61 acre)

(NOT EXACTLY TO SCALE)


UNIVERSITY OF KERALA
MAP OF KARIAVATTOM CAMPUS
(NOT EXACTLY TO SCALE)
SOUTH CAMPUS
1. SOUTH CAMPUS MAIN ENTRANCE
2. ATM
3. SECURITY WING
4. CGIST (Centre for Geo-Information Science & Technology)
5. CAFETARIA
6. STATE BANK OF TRAVANCORE
7. F-TYPE QUARTERS
8. 11.K.V. SUB STATION
9. ELECTRICAL SECTION
10. ENGG: SUB:DVN.
11. ADMN: UNIT & ENGG: UNIT
12. ENGG: STORE
13. BUS GARRAGE
14. POST OFFICE
15. CAMPUS COMPUTING FACILITY, CSS OFFICE
16. CANTEEN
17. STUDENTS UNION OFFICE
18. OPTO ELECTRONICS
19. PURSE INSTRUMENTATION FACILITY
20. AQUATIC BIOLOGY & FISHERIES, FUTURE STUDIES
21. CAMPUS LIBRARY
22. GANDHI BHAVAN, ENV. SCIENCE
23. ARTS BLOCK No. I (History, Politics, Economics, Sociology, Islamic Studies)
24. ARTS BLOCK No. II (Arabic)
25. ORI & MANUSCRIPT LIBRARY
26. O.H.TANK
27. DEPT. OF ARABIC
28. ORIENTAL BLOCK (Malayalam, Philosophy, Linguistics, Tamil, Sanskrit)
29. HATCHERY BLDG.
30. PUMP HOUSE & WELL
31. SCIENCE BLOCK II (Geology, Statistics, Maths, Psychology, Demography, Comp. Science)
32. BIO TECHNOLOGY
33. CASH COUNTER
34.SCHOOL OF BUSINESS MANAGEMENT & LEGAL STUDIES (Commerce, Law, IMK)
35. PLAY GROUND
36. SCIENCE BLOCK III (Chemistry)
37. BIO CHEMISTRY
38. PHYSICS BLOCK
39.G.J. BUILDING (College of Engg, Hindi, ICKS)
40. WORK-SHOP (USIC)
41. MEN'S HOSTEL (P.G)
42. MEN'S HOSTEL (RESEARCH)
43. HEALTH CENTRE
44. WOMEN'S HOSTEL (P.G)
45. WOMEN'S HOSTEL (RESEARCH)
46. QUARTERS
47. TEACHERS HOSTEL
48. B. TYPE QUARTERS
49. A. TYPE QUARTERS
50. O.H.TANK
51. GUEST HOUSE
52. ARCHAEOLOGY DEPT.
53. NURSERY SCHOOL
54. C. TYPE QUARTERS
55. D. TYPE QUARTERS
56. E. TYPE QUARTERS
57. OPEN AIR AUDITORIUM
58. CAMPUS ASSOCIATION
59. CO.OP. STORE
N
S
Perumonchira
Lakshmi Bhai National College of Physical Education(50 acres)
Stadium (Under Construction)
(40 acres)
Govt. College Kariavattom (15 acres)
Kumizhikara
Pond (Kundettukonam Chira)
Kundettukonam Kavu (Sacred Grove)
UTECH
Church
Temple
School
To Trivandrum
Mosque
Kariavattom Jn.
Thodu
Nettekonam
K.H.R.I 3 acres (Lease)
Exchange
Mosque
NH
To Kollam
Pond (Echilatt Kulam)
Ambalathinkara
Pond
Pond (Pullekonam Chira) aka Hymavathy Kulam
Technopark Centre (50 acres)
Wet Land
Kunnumpuram
Vallathodu Kavu (Sacred Grove)
Thrippadapuram Temple
NORTH CAMPUS
60. SCIENCE BLOCK I (Zoology, Botany, Communication & Journalism)
61. GREEN HOUSE
62. GAMA SHINE UNIT
63. ANIMAL HOUSE
64. OPEN STAGE
65. BIOINFORMATICS BLOCK
66. O.H. TANK
67. MAIN PUMP HOUSE
TRADITIONAL PLACE NAMES
A UPPANNIKONAM THOPE
B NIRAPPIL C PATTANI KUNNU
D PULLUNATTA VILA E PULLEKONAM
F PESHKAR KUNNU G VAIDYAN KUNNU


N
TO KAZHAKUTTOM.
NH.47
TO KARIAVATTOM
MAINGATE
TEACHERS HOSTEL
MENS HOSTEL
MENS HOSTEL
CAMPUS ROAD
SBT
F1-F10 QUARTERS
SECURITY OFFICE
POSTOFFICE
HEALTH CENTRE JUNCTION.
CAMPUS LIBRARY
CAMPUS LIBRARY JUNCTION
GUEST HOUSE
CHILDRENS PARK
HEALTH CENTRE
WOMENS HOSTEL
NURSERYSCHOOL
NURSERY SCHOOL JUNCTION.
THRUPPADAPURAM ROAD.
OPEN AIR AUDITORIUM.
CAMPUS ASSOCIATION OFFICE.
SOCIETY PROVISION STORE.
TO TECHNOPARK.
LOCATION MAP OF CAMPUS ASSOCIATION.
[NOT TO SCALE.]
PREPARED BY: R. RADHAKRISHNAN, OVERSEER-GR.I, ENGINEERING UNIT.

Part G: Appendix

- **Graduate Attributes**
- **Student start-up scheme of UoK**
- **MOOC & Using Social Media for Academics**
- **Assisting Quality & Excellence : IQAC**
- **Special Information for Non-Kerala Students**
- **Contact Numbers of Teaching Faculties**
- **Percentage of Similarity in PhD thesis in State Universities is less than 10%**
- **Annual Researchers Survey 2016**
- **Inputs on Research from Industries & Other Stakeholders**

G1: Graduate Attributes: The ideal Kerala University Graduate

Attributes of an ideal graduate of the University of Kerala has been attriculated in "Graduate Attribute" statement:

A graduate of University of Kerala shall ...

- *Continuously strive for excellence in education*
- *Continue life-long learning as an autonomous learner*
- *Apply and nurture critical and creative thinking*
- *Promote sustainable development practices*
- *Promote co-operation over competition*
- *Balance rights with responsibilities*
- *Understand and respect diversity and difference*
- *Not be prejudiced by gender, age, caste, religion, or nationality*
- *Use education as a tool for emancipation of humanity*

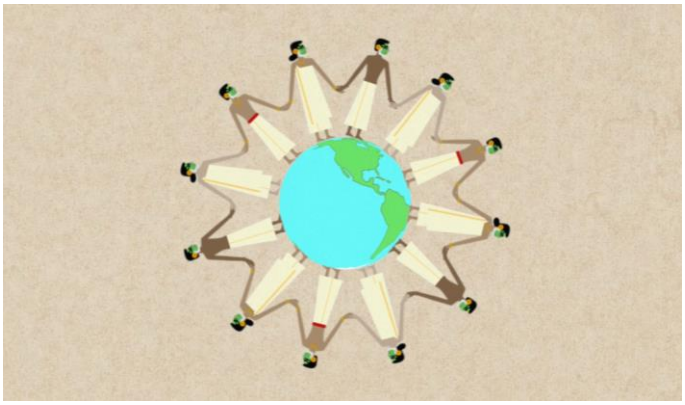
Visualization of graduate attributes can be viewed at:
http://www.iqac.keralauniversity.ac.in/graduateVdo.php

: Continuously strive for excellence in education

: Continue life-long learning as an autonomous learner

: Apply and nurture critical and creative thinking

: Promote sustainable development practices



: Promote co-operation over competition

: Balance rights with responsibilities

: Understand and respect diversity and difference

: Not be prejudiced by gender, age, caste, religion, or nationality

: Use education as a tool for emancipation of humanity

G2. Student Start-up scheme of University of Kerala

The age of start-ups have arrived, no doubt. The 'Start-up village" in Kerala and "Start-up India, Stand-up India" initiative of Central government reconfirm this. There is a concentration of the idea around technological instituitions, mainly engineering colleges. The tremendous scope of campus-based start-ups in Universities and Arts and Science colleges remain to be exploited. University of Kerala, a multi-disciplinary University with 42 departments ranging from Sanskrit, Arabic, Sociology and Psychology to Optoelectronics, Bio-technology and Computer Science, presents a very unique eco-system for campus start-ups. A campus which can boast of cutting edge data servers, scanning electron microscopes and drug docking softwares is also known for centuries old sanskrit palm leaves, garden of medicinal plants and clinical psychology laboratories. The diversity and its synergy present different and unique possibilities.

The University of Kerala started its experiments with start-ups, as early as in 2006, when it established an Industry Incubation Centre (IIC) and successfully incubated a student start-up – Soorya Kiran Bioinformatics Pvt. Ltd. The University has recently re-established the IIC as "KU-TBSC" (Kerala University Technology and Business Start-up Centre). The KU-TBSC scheme mainly provides space and facilities for the start-up to function at a very nominal rate compared to other established incubation centres. Space will be provided, if possible, within the student's respective departments. All facilities and faculty of the department can be advertised by the student start-up as available to them (on a consultancy basis, as per University's Consultancy Guidelines). Our University start-up scheme, unlike most engineering college incubation centres, is not just

focusing on technology based start-ups alone, but encourages the students from every department to enthusiastically think about providing products/ services from their field.

Students meeting successful Start-Up heroes as a part of their Start-Up preparation.

KU-TBSC is working towards a dedicated building, with a corporate front office, complete with a receptionist, seminar/meeting room, waiting area, etc. Start-up offices will be raw work cubicles with all facilities like Wi-Fi, but unfurnished, to keep the costs low.

Profile of a Campus Start-up from University of Kerala

Dr. Dhanyalekshmi C.S

Dr. Roshin Elizabeth George

Dr. Shirly K.Thomas

BIOVENT
Solution for Research Challenges

BIOVENT is a start-up under KU-TBSC (Kerala University – Technology & Business Start-Up Centre) scheme working at the Department of Biotechnology, University of Kerala, Kariavattom Campus, Thiruvananthapuram. BIOVENT is founded in 2017 by academic entrepreneurs from Biotechnology and Microbiology. The venture focuses on high quality analytical service in Biotechnology, Microbiology, Biochemistry, as well as

other streams of life science, innovation outcomes in terms of society beneficial research or interventions, develop technologies useful to Biomedical research, learning collaborations, patents and other beneficial knowledge outputs. BIOVENT is supported by the KU-TBSC, Department of Biotechnology and Sophisticated Instrumentation and Computation Centre (SICC), University Kerala. The facilities are mainly provided by the Department of Biotechnology and Sophisticated Instrumentation and Computation Centre (SICC), University of Kerala.

BIOVENT is started by former Ph.D students of Department of Biotechnology, Dr. Dhanyalekshmi C.S, Dr. Roshin Elizabeth George and Dr. Shirly K. Thomas. Prof. Dr. Achuthsanker S. Nair, KU-TBSC Director and Dr. Jayakumaran Nair, Head of the Department of Biotechnology are the mentors of the BIOVENT. Padmashree Prof. Dr. Palpu Pushpangandan, Director General, Amity Institute of Herbal and Biotech Products Development, Dr. Varughese George, Director, Amity Institute of Phytochemistry and Phytomedicine, Dr. V P. Potty, Principal Scientist (Microbiology and Microbial Biotechnology (Rtd.), CTCRI, Trivandrum and Dr. Radhakrishna G Pillai, Assistant Professor, Department of Life sciences, University of Calicut, Kerala are the advisers of BIOVENT.

Services offered are Screening of molecules for bioactivity, Screening of anti-cancerous compounds, Quantitative and qualitative analysis of various biomolecules, Microbiological / Quality testing of water and food samples, Molecular level identification of bacteria and fungi, PCR and SDS-PAGE sample analysis, Preparation of samples for genome sequence analysis and DNA sequencing, Recombinant DNA techniques, Phytochemical analysis, Enzymology, Protein- expression, extraction, purification and characterization, Animal cell culture works, HPLC analysis of compounds and analysis using other instruments available in the laboratories. Future goals to achieve include production of waste to value added products like enzymes, fertilizers etc. Developing waste treatment and water treatment facilities/ equipments. For more details: www.biovent.co.in


UNIVERSITY OF KERALA
कर्मणि व्यज्यते प्रज्ञा
DREAMING OF A
STUDENT
START-UP?
APPLY TO
KU-TBSC
(KERALA UNIVERSITY TECHNOLOGY &
BUSINESS START-UP CENTRE)
APPLY BY
30
JULY 2017
TECHNOLOGY BUSINESS START-UPS IN OUR UNIVERSITY CAMPUS
SPACE AND EQUIPMENTS AT NOMINAL RENTS
MENTORSHIP AND GUIDANCE FROM EXPERTS
UTILISE HOST DEPT. FACILITIES ON CONSULTANCY BASIS
(requires consent of Dept.)
ATTEND A SEMINAR/DISCUSSION FORUM ON
20 JULY 2017 TO CLARIFY DOUBTS
(email team.iqac@gmail.com to register for seminar)
CONTACT: DIRECTOR, KU-TBSC, C/o IQAC, UNIVERSITY OF KERALA, THIRUVANANTHAPURAM
Email: team.iqac@gmail.com

Template for MOU for Start-up <Company name>

Between **University of Kerala and <Company name>**

This Memorandum of Understanding (hereinafter called the "MoU") is entered into by University of Kerala (hereinafter called "University of Kerala" or "University") and <company name>, a company/ partnership registered under the Indian …..... Act, 19...' And WHEREAS University of Kerala facilitated an Industry Incubation Centre (vide order no. PLA/418/2006 dated: 14/06/06), renamed as Kerala University Technology and Business Start-up Centre, KU-TBSC, (vide order no. P1.A1/2806/IQAC/15 dated 12/04/2016*)* at Kariyavattom campus for promoting entrepreneurship in University students.

WHEREAS <Company name> is a start up by the alumni of University of Kerala, offering <company services>.

THIS MEMORANDUM sets out the principles of association and roles expected from both parties as follows.

1. The company/ firm being incubated shall agree to all terms and conditions as stated here in and further as decided by the University from time to time.
2. The company/ firm shall be a registered entity within 6 months of starting its operations. All operations of the company shall be governed by provisions of the acts under which it is registered.
3. The University shall not be held responsible/ made a party in any legal dispute arising out of either direct or indirect actions of the company/ firm or the direction of the company/ firm.
4. The company/ firm shall be responsible for upkeep of the space allotted to them and also for the working condition of the equipments allotted to them, except normal wear and tear.
5. The equipments allotted to the company/ firm shall be used only for activities of the company/ firm. Space shall not be sublet to any other individual/ operations.
6. Rental for the space and equipments shall be fixed by the University according to guidelines evolved by Advisory Board of KU-TBSC. Any default in payment of rentals by due date shall be penalized at less than 10% of the amount concerned for first 6 months and at rates fixed unilaterally by the University, thereafter.
7. Rental shall be fixed initially at less than 25% of market rates (excluding Technopark), and re-fixed unilaterally after first year by University.
8. Rental for all equipments like PC, Printer etc. shall be at mutually agreed rates.
9. Any running expense incurred other than routine expenditure (like installation of heavy loads etc.) shall be reported to the KU-TBSC and shall be charged as per actuals.
10. If the company/ firm makes working profit from third year of its existence, it shall payback twice the amount of subsidy in rentals or 25% of its net profit which ever a higher.
11. Any utilization of services of faculty/ facilities of Departments/ Centers shall be as per existing consultancy guidelines of University and variation shall be with express permission of Advisory Board of KU-TBSC.
12. The Company/ firm shall ensure that their activities do not disrupt any of the activities of the Departments in the Campus. They shall also abide by the general rules and guidelines of conduct of the campus, in so far as it is applicable to them. The University shall, subject to the above, ensure smooth operational environment to the company/ firm.
13. Any dispute arising out of the MoU shall be attempted to be settled by mutual discussions between the advisory board and the representatives of the company/ firm, before recourse to legal action with Trivandrum Jurisdiction.
14. Any interaction between University and the company which involves IPR shall be based on a written agreement, in the absence of which the concerned IPR shall vest with the University.
15. The undersigned have read and agreed to all the terms above.

For <Comapny name>	For University of Kerala
<designation>	Registrar
Witness: 1.	2.

G3.MOOC & Using Social Media for Academics

Social media is hangout place of youth, and fun and friendship reign supreme in the social media. But a part of the space can be also used to further your academic growth. Here are some suggestions to use cyber space to further academics:

1. Contribute at least one article to Wikipedia (English or Malayalam or your mother tongue). Choose a topic related to your family, village, school etc., or a topic of academic or co-curricular interest to you.
2. Create an Email group or what's App group on an academic topic.
3. Make frequent Facebook posts on academic topics. You can learn from the diverse reactions made by others.
4. Use LinkedIn to connect to professionals in your subject.
5. Register in sites such as Research Gate and follow scholars in your subject, raise and answer questions.
6. Watch motivating lectures in YouTube. TED talks are short and punchy. They feature a wide range of persons, scientists, physically challenged, scientists, musicians, technologists, business magnets….

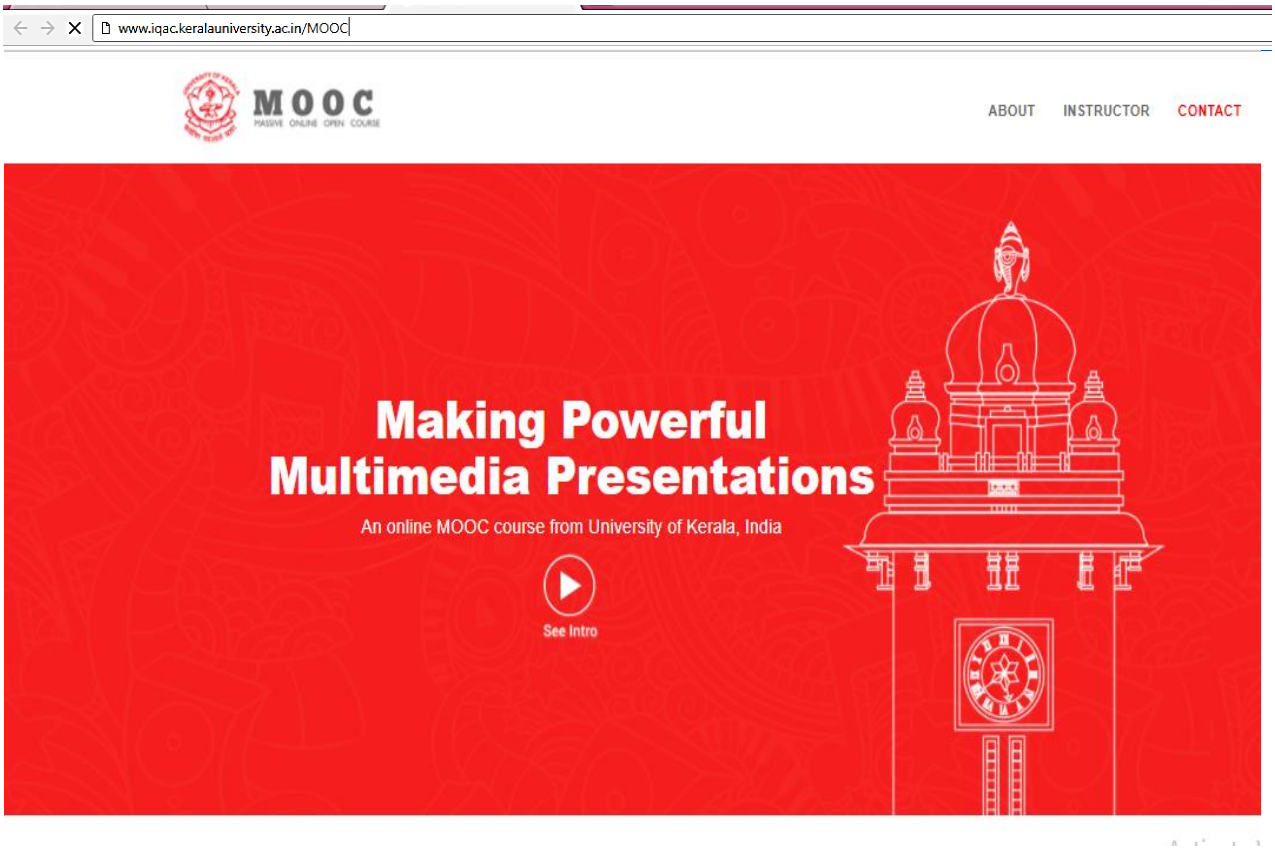
Massive Open Online Courses (MOOC) is an excellent way to come out of the syllabus and also to experience contrasting academic cultures and perceptions. Web sites such as Coursera, Edx, Udacity etc. offer variety of free online courses from world-class Universities. You can choose courses related to your subject of study or interest and also many others of general interest, many of which enhance your soft skills. Some examples are:

10. Ignite Your Everyday Creativity by The State University of New York
11. Creative Problem Solving by University of Minnesota (https://www.coursera.org/)
12. Creativity, Innovation, and Change by Pennsylvania State University
13. Understanding Research Methods by University of London
14. Learning to Learn
15. Soft skills
16. Project Management

Another area to choose free online courses is that of foreign/additional languages which will widen your placement opportunities: Arabic, Chinese, Japanese, Sanskrit, Tamil, German, French and Russian

The MHRD, Govt. of India has meanwhile launched a MOOC platform named SWAYAM and has started offering courses through it.

University of Kerala also has started offering MOOCs since 2017. Look out for new courses from University Web Site.



2017 Highlights: This Year's Top-Rated Specializations

Choosing a Specialization to take in 2018? These 10 were among the best-rated on Coursera this year - join today to see what the buzz is about.*

Top-Rated in **Business**

Entrepreneurship

The Wharton School of the University of Pennsylvania | 5 courses

RATING:

REVIEW: *"It provides quantifiable tools that can help me take an idea from a notebook doodle onto an actual working prototype - thank you for this!"*

Enroll Now

2 **Investment Management**

University of Geneva | 5 courses

RATING: ★★★★½

REVIEW: *"Great course. Very practical with many guest lectures who give great insights in their respective fields."*

Enroll Now

3 **Construction Management**

Columbia University | 4 courses

RATING: ★★★★½

REVIEW: *"Excellent and insightful. It clearly explains crucial concepts and introduces excellent modern methods in current use and the future of project management."*

Enroll Now

Top-Rated in **Data Science**

1 **Deep Learning**

deeplearning.ai | 5 courses

RATING: ★★★★½

REVIEW: *"Awesome... Best Specialization I have ever taken. Another 'best course' from the godfather of machine learning."*

Enroll Now

2 **Geographic Information Systems (GIS)**

University of California, Davis | 5 courses

RATING: ★★★★½

REVIEW: *"Instructor Nick Santos has terrific presentation skills and his knowledge of the material is beyond reproach... I could not be more pleased with this course."*

Enroll Now

3 **Machine Learning**

University of Washington | 4 courses

RATING: ★★★★½

REVIEW: *"Fantastic course, great 'learn-by-doing' introduction to ML, really entertaining teachers kept me alert throughout each session. It was great fun!"*

Enroll Now

Top-Rated in **Computer Science**

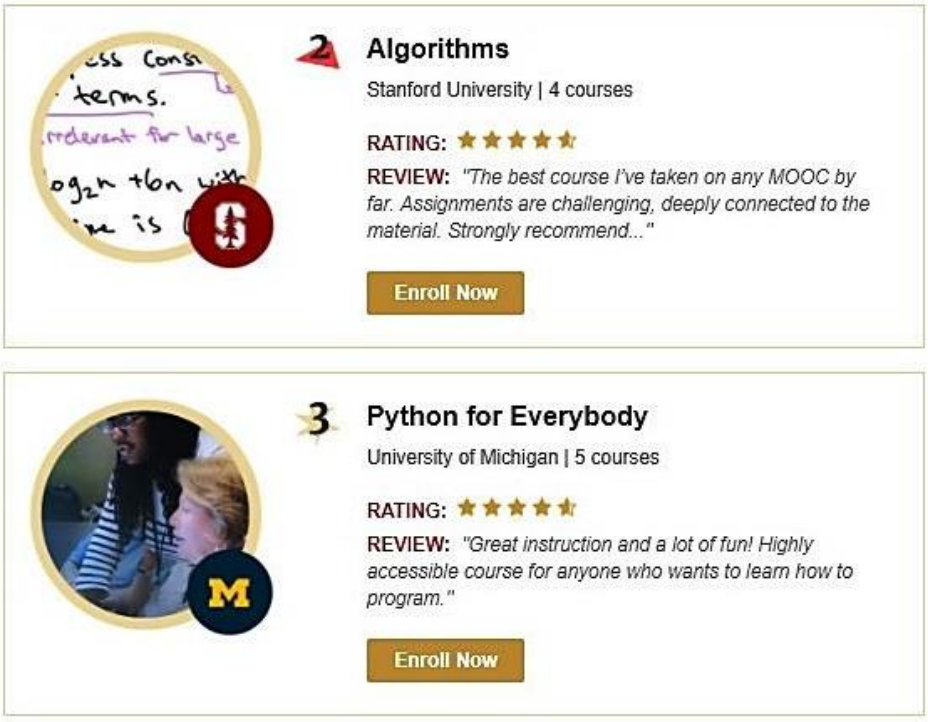
1 **Fundamentals of Computing**

Rice University | 7 courses

RATING: ★★★★½

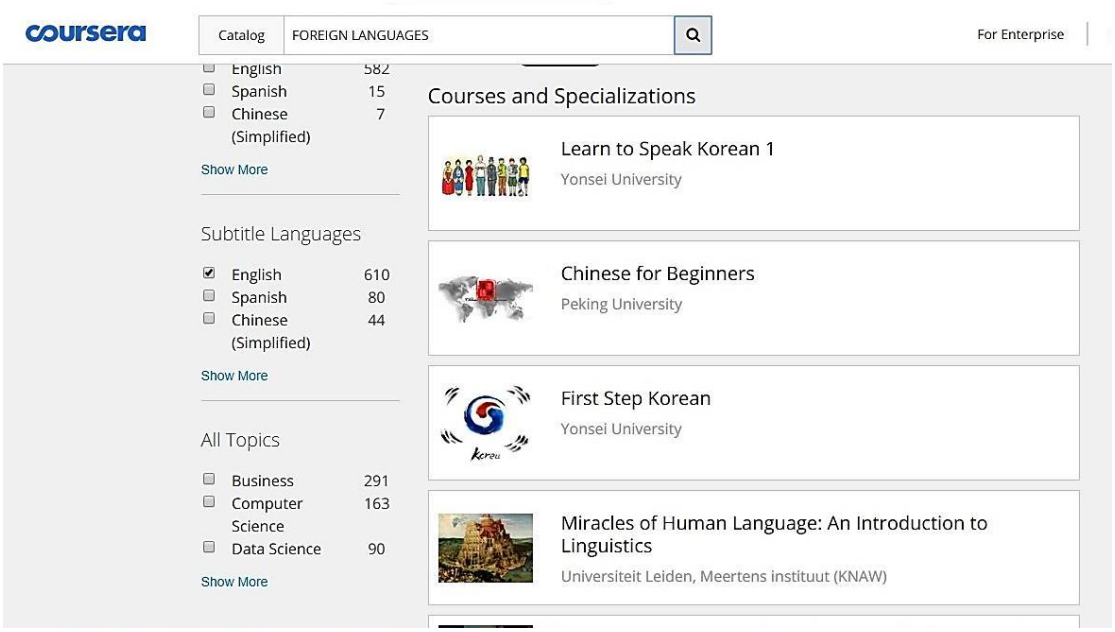
REVIEW: *"It has been invaluable to me as a beginning programmer to learn not just the basics of the language, but most importantly how to break the problem into smaller manageable chunks."*

Enroll Now



Top-Rated in **Humanities & Social Science**


3
Creative Writing
Wesleyan University | 5 courses
RATING:
REVIEW: "This has enriched my life and given me such purpose and drive. Fantastically put together..."
Enroll Now
*Ranking based on highest-rated, completed Specializations with 1000+ ratings. Reviews sourced from Course #1 of the Specialization.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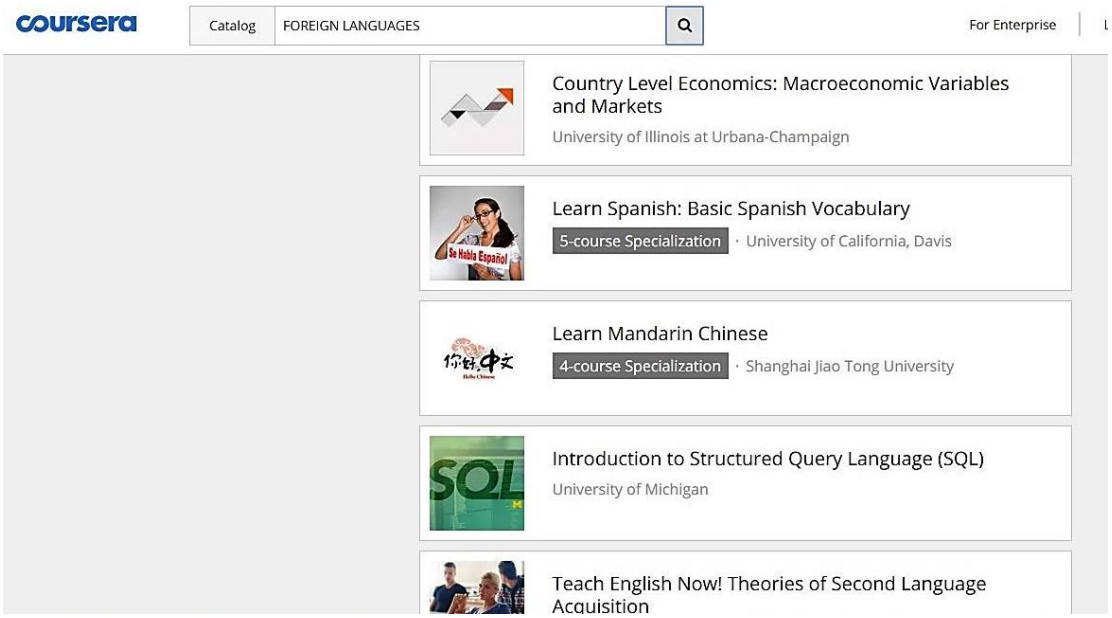
Chinese for Beginners
Peking University
First Step Korean
Yonsei University
Miracles of Human Language: An Introduction to Linguistics
Universiteit Leiden, Meertens instituut (KNAW)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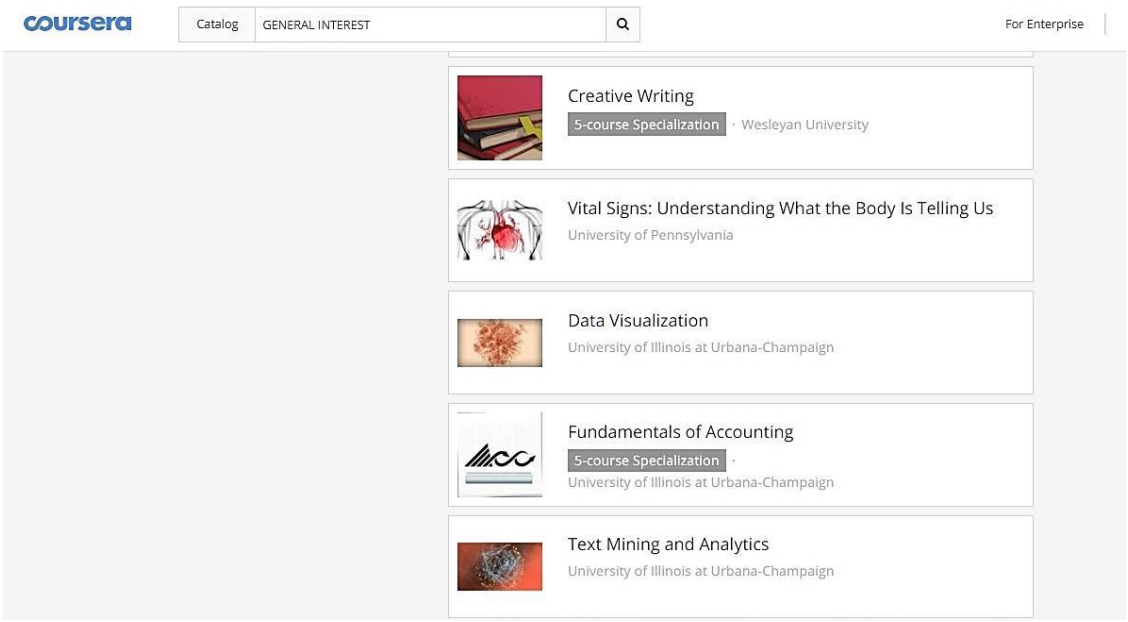
University of Illinois at Urbana-Champaign
Learn Spanish: Basic Spanish Vocabulary
5-course Specialization · University of California, Davis
Learn Mandarin Chinese
4-course Specialization · Shanghai Jiao Tong University
Introduction to Structured Query Language (SQL)
University of Michigan
Teach English Now! Theories of Second Language Acquisition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Data Visualization
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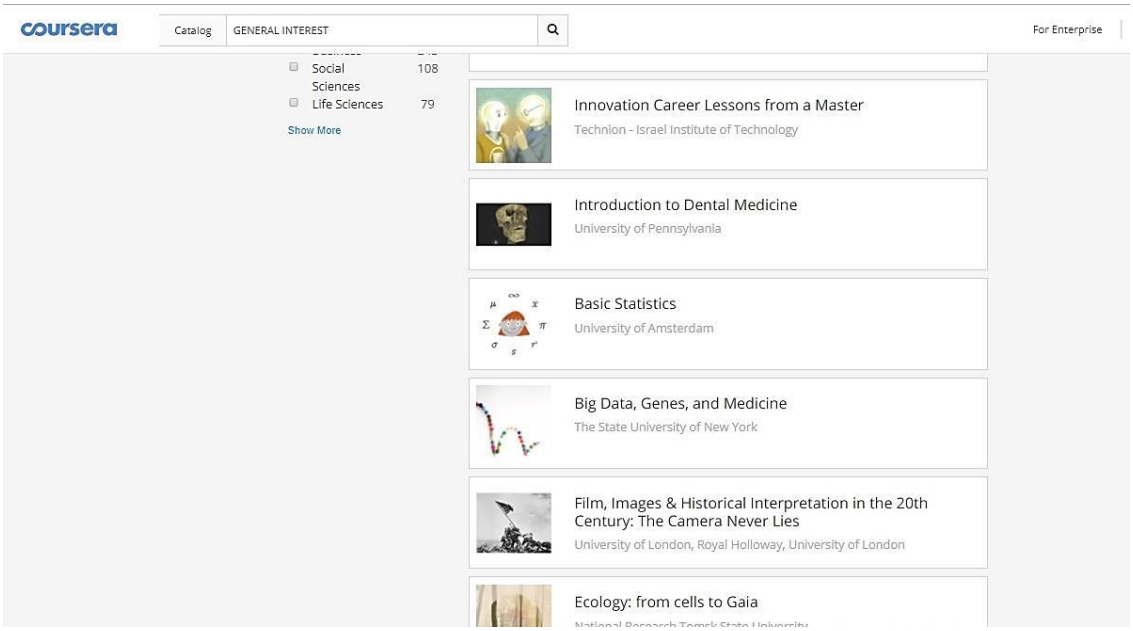
University of Illinois at Urbana-Champaign
Text Mining and Analytics
University of Illinois at Urbana-Champaign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The State University of New York
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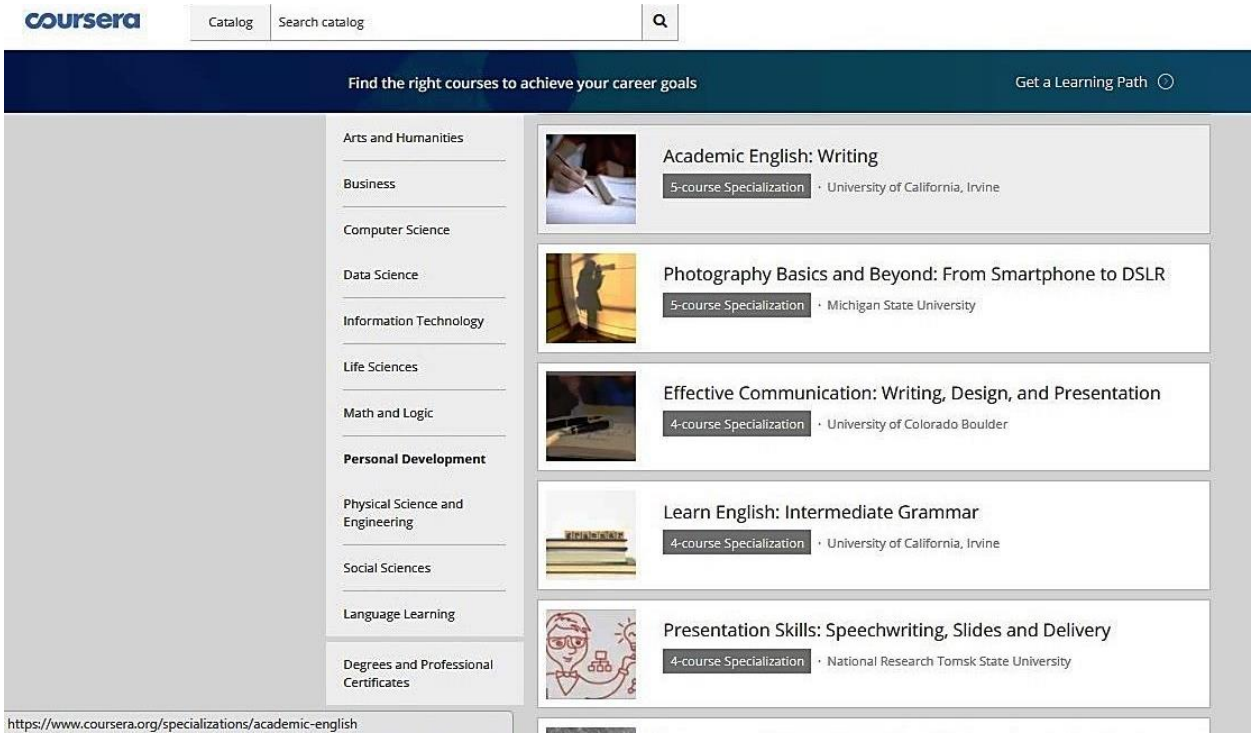
University of London, Royal Holloway, University of London
Ecology: from cells to Gaia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Photography Basics and Beyond: From Smartphone to DSLR
5-course Specialization · Michigan State University
Effective Communication: Writing, Design, and Presentation
4-course Specialization · University of Colorado Boulder
Learn English: Intermediate Grammar
4-course Specialization · University of California, Irvine
Presentation Skills: Speechwriting, Slides and Delivery
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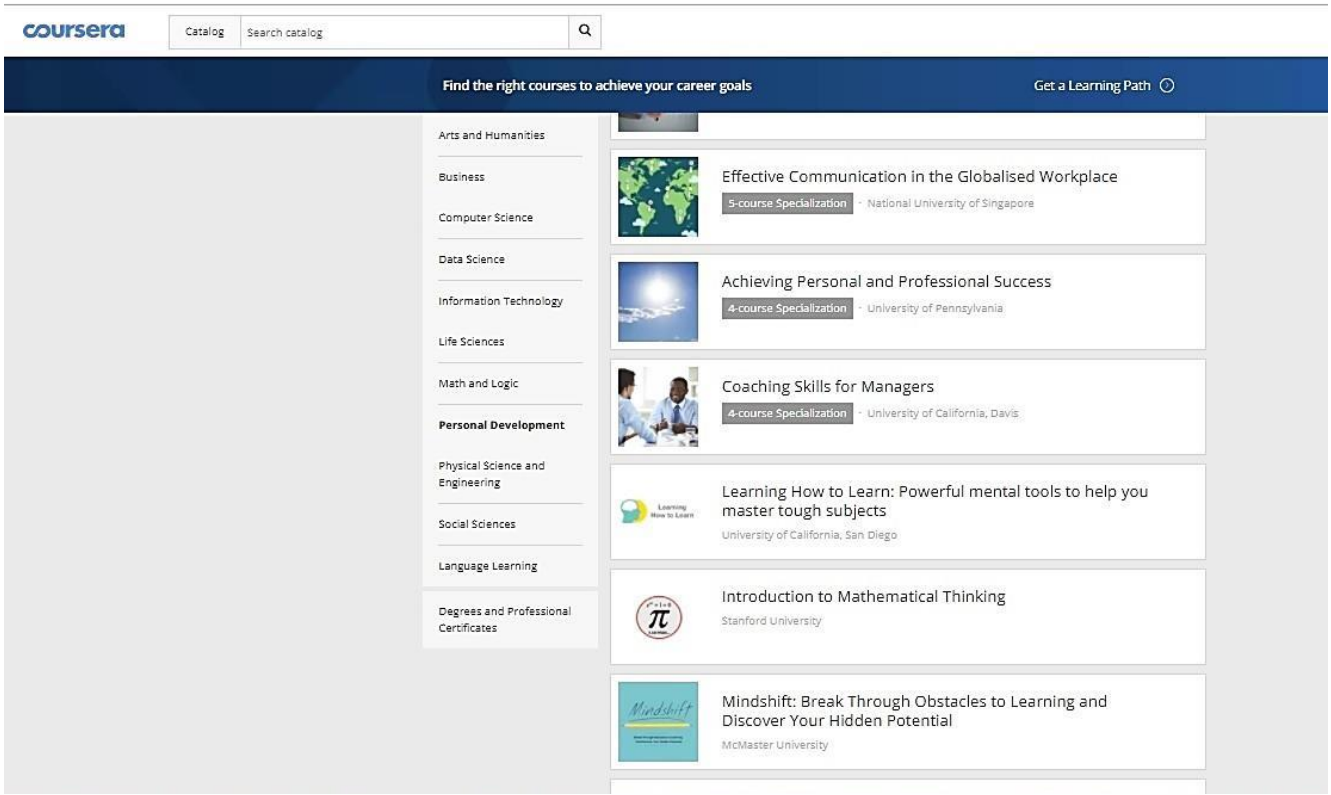
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Achieving Personal and Professional Success
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Coaching Skills for Managers
4-course Specialization · University of California, Davis
Learning How to Learn: Powerful mental tools to help you master tough subjects
University of California, San Diego
Introduction to Mathematical Thinking
Stanford University
Mindshift: Break Through Obstacles to Learning and Discover Your Hidden Potential
McMaster University

G4. Assisting Quality and Excellence: IQAC

This section is aimed to create awareness about University's Quality initiatives among students. At the absent it must be understood that the quality of a University is the quality of its students. All University systems fundamentally aim to bring out the quality latent in every student. Therefore an awareness of the initiatives related to quality and involvement in them by students is essential.

Internal Quality Assurance Councils (IQACs) are set up in all Universities as per requirements of National Assessment and Accreditation Council (NAAC), an initiative of UGC. As per UGC guidelines, the mandates of IQAC are as follows:

Goals: 1) To develop a quality system for conscious, consistent and catalytic programmed action to improve the academic and administrative performance. 2) To promote measures for institutional functioning towards quality enhancement through internalization of quality culture and institutionalization of best practices.

Objectives: ♦Development and application of quality benchmark parameters for various academic and administrative activities of the institution. ♦Promote and facilitate various academic activities of the University and make them as good practices. Facilitate the creation of a learner centric environment conducive to quality education. ♦To act as a change agent in the institution so as to ensure quality. Initiate the implementation of feedback responses from all stake holders on quality related institutional processes. ♦ Documentation of the various programmes/ activities leading to quality improvement.

Strategies: ♦Ensure timely and efficient performance of academic and extra-curricular activities. Maintain quality of academic and research activities. Ensure an error free evaluation procedure. ♦Facilitate the modern methods of teaching and learning. Measures for ensuring quality sustenance and quality enhancement.

Functions: ♦Formulation and implementation of quality benchmark for various programmes and activities of the university. ♦Documentation of various activities/ programmes organized in the University. ♦Organise training programmes on quality related themes. Preparation of Annual Quality Assurance Report (AQAR) to be

submitted to NAAC. ♦Prepare the University for the next cycle of reaccreditation and elevate it to the status of a world class institution.

The present IQAC of University of Kerala has the following composition:

1. Vice - Chancellor, UoK **(Chairman)**
2. Pro Vice - Chancellor, UoK (Vice-Chairman)
3. Convener, Standing Committee of the Syndicate on Academics & Research, UoK
4. Convener, Standing Comm. of the Syndicate on Depts. & other Inst. of the Uty, Uok.
5. Registrar, UoK
6. Finance Officer, UoK
7. Vice -Chairman, Credit and Semester System, UoK
8. Director, Computer Centre, UoK
9. Chairman Departments' Union, UoK
10. Anoop M. Ambika, CEO & Managing Director Cognub-Decision Solutions Pvt. Ltd.
11. Dr. K.P Jaikiran, Programme Director, FLAIR, Govt of Kerala
12. Dr. M. Sarngadharan, UGC Emeritus Professor, UoK
13. Dr. Jayachandran R., Assoc. Professor & Head, Dept. of Hindi, UoK
14. Dr. S. Shifa, Associate Professor, Department of Malayalam, University of Kerala
15. Dr. E. Shaji, Asst. Professor, Dept. of Geology, UoK
16. Dr. Mushtaq Ahammed, Asst. Prof.(Commerce) , School of Distance Education, UoK
17. Dr. Joseph Antony, Assoc. Prof. and Head, Dept. of Political Science, UoK
18. Dr. Bushra Beegom R.K., Asst. Professor, Dept of Sociology, UoK
19. Dr. Divya.C.Senan, Assistant Professor, Dept. of Education, University of Kerala
20. Dr. Achuthsankar S. Nair, Prof., Bioinformatics, UoK **(Director, IQAC)**

In the rest of this section, a few initiatives of IQAC are explained.

T-LARC: It is a central body, as envisaged by NAAC/UGC, to review the teaching, learning and assessment process in the University. This has come into existence vide U.ONo Ac.D/IQAC/2/7311/2015 dated 10/12/2015. Pro-Vice-chancellor is the Chairman. T-LARC meets twice a year to discuss student feed-back, assessment samples, and also review the Academic Audit Report of Depts. from the perspective of teaching, learning and assessment and make recommendations for improvement. T-LARC publishes students feedback summary for each year.

Master Action Plan: The Master Action Plan (MAP) to improve quality is a listing of 350 points classified under eight focal areas: 1.Vision, Framework & Benchmarking 2.Research & Innovation 3.Teaching, learning & Evaluation 4.Schools, Depts.& Centers 5.Student Development 6.Governance 7.Extension 8.Miscellaneous. They have been

drawn up by considering the parameters recognized by NAAC and UPE scheme. In addition, the IQAC has also deliberated and contributed its collective wisdom. This document is expected to be the road map for the University in its journey towards excellence. At the end of 2016, 37% of items in MAP has been either initiated or completed.

Annual Student Survey: An annual student survey is conducted every year, aimed at understanding the student cohort's social, academic, entrepreneurial and aspirational background, so as to enable the teachers and administrators to serve them better. 81 questions are asked under 9 heads. The responses to these have been compiled and published. The annual conduct of this survey is expected to also provide an indication of changing social backgrounds and student population. Here are some highlights of last student survey: 78% of students are in age group of 20 – 22; 77% are female. Highest qualification of parents of around 36% students is SSLC. 8% of students face some crisis in family. 2% of students have serious health issues. 97% of students have Aadhar Card. 41% of students studied SSLC in Govt. School. 43% of students studied SSLC in Malayalam medium. 54% own a laptop and 95% own mobile phones (72% smart phones).

AQAR: The Annual Quality Assurance Report (AQAR), is a major documentation of University's quality activities, required to be filed every year. Reports of 2015 and 20116 are published in the IQAC website.

Bench Mark Series: As per the goals and functions of IQAC defined by UGC, development and application of quality benchmark and parameters has prime importance. Bench mark series of IQAC is aimed to help stake holders to understand different facets of the University system in contrast to local & global peers. Three reports are published in IQAC website.

Teaching & Learning Innovations: This compilation is a non-exhaustive collection of innovative practices in teaching/assessment/ class-room management that are reported by teachers. A set of suggestions by IQAC for improve teaching and learning has also been included in this compilation.

Academic Audit: The report of the first Academic Audit of the University of Kerala was brought out in 2015. It has been conducted as a faculty driven self-reflection and peer feedback. The Departments themselves have chosen peer reviewers and have resolved on taking steps based on peer review.

eBook Project: The eBook series launched by IQAC has multiple aims (i) to provide a platform for speedy publications of scholarly works;(ii) to promote dissemination of scholarly thoughts and new findings in a free manner, under a Copy left license; and to (iii)promote out- reach activities of UoK, Six eBooks have been released under Creative Commons CC-BY-NC-ND (Attribution - Non Commercial- No Derivs) license.

What should our University research on? IQAC has taken multiple steps to invite suggestions from all stake holders of the University, from general public, alumni, local and national Industries and organizations through direct communications, media releases and also using social media. These have been compiled and published in IQAC website. It is published for the benefit of students & research scholars of the University. This compilation is an important activity aimed at connecting research to real-life problems. Many of the problems highlighted by the proposers are worth first consideration by researchers, as their utility is automatic. Kerala Minerals and Metals has, for instance, pin-pointed their problem: that of developing means of using the two lakh metric ton of waste iron oxide and ETP (Effluent Treatment Plant) solid. The Innovation Lab of Tata Consultancy Services (TCS) has proposed a collection of exciting technological problems. Many other organizations and individuals have made innovative suggestions such as synthetic blood to attract mosquitos, cocopistol to estimate tenderness of coconuts and so on.

Gender Audit: A committee appointed by IQAC conducts gender audit every year. Three gender audits are been conducted by IQAC and each reconfirms the women majority in all sectors except top echelons of power, in the University.

Consultancy: IQAC has compiled a comprehensive brochure on consultancy services and sent out copies of the same to 150 potential clients. The annual turnover from routine and non-routine consultancy during 2015 has been Rs. 61 lakhs. Recent major clients have been Kerala State Bio-diversity Board, Israel Agency for Development of Aquaculture in Kerala, Biothera Health Care, Govt. Ayurveda College, Trivandrum Corporation, Reliance, etc.

Induction Programme: Induction programme for newly admitted PG students have been organized at School level and Dept. level during September 2016 and the report has been compiled and published by IQAC. Streaming of Graduate Attributes Video designed by IQAC, Annual Student Survey, introducing school and department, talks on learning strategies etc. have been arranged by various Departments.

PWD Audit: Audit of students and staff with disability has been conducted by IQAC and published, along with helpful information such as text of the recent Act on Persons with Disabilities.

Centres under University: IQAC has compiled quick profile of all centres, non-teaching Departments, cells and committees of the University and has published it in the IQAC website.

Policies/Charters: Fifteen policies and charters compiled by various committees appointed by IQAC has been approved by the syndicate of the University of Kerala for consideration of Academic Council.

1000 Wiki Lights: "1000 Wiki Lights" is aimed to get students, researchers and faculty to contribute "copy-left" articles through Wikipedia to enrich the cyber knowledge world. This is done in collaboration with Depts. Union and Researchers Union.

Library Audit: Libraries continue to be critical re-source and eco-system of academic activities for scholars and students. The library audit by IQAC collects and presents a summary of basic data of our library system. The audit of 2015 which covered 46 libraries reveals the following:

♦ Total Number of Books (KUL-3.4, Others 4.8): 8.2 Lakhs ♦ Acquisition During 2015: 0.2 Lakhs of books ♦ Cost of Books Purchased in 2015: Rs. 311 Lakhs ♦ Annual Growth rate of stock: 2.4% ♦ Average Cost of Books: Rs. 1992/- ♦ Utilization Rate (Books issued/ member/year): Ranges from 192 to 1 ♦ Library Space Provision (Sq.ft/member): Ranges from 200 to 1 ♦ Library Seating Facility (Seats/member): Rang-es from 2 to 0.02 ♦ Total No. of Library Staff (Permanent): 119 Contract: 24 ♦ Cataloguing: 86% of libraries ♦ Classification: 85% of Libraries (Most use Dewey Decimal Classification, but 3 Departments and KUL uses Colon Classification)

Green Charter: All IQAC events have given maximum care to follow Green Charter of the University (U.O. No Ad.Misc./3/NAAC/GC/2014). Events of IQAC have avoided bottled water, plastic cups and plates and plastic covered bouquets. Use of registration kits which are eco-friendly, with rola pens (with body made up of recycled rolled paper), ethnic food in preference to junk food. Banners made of cloth-base, etc are promoted

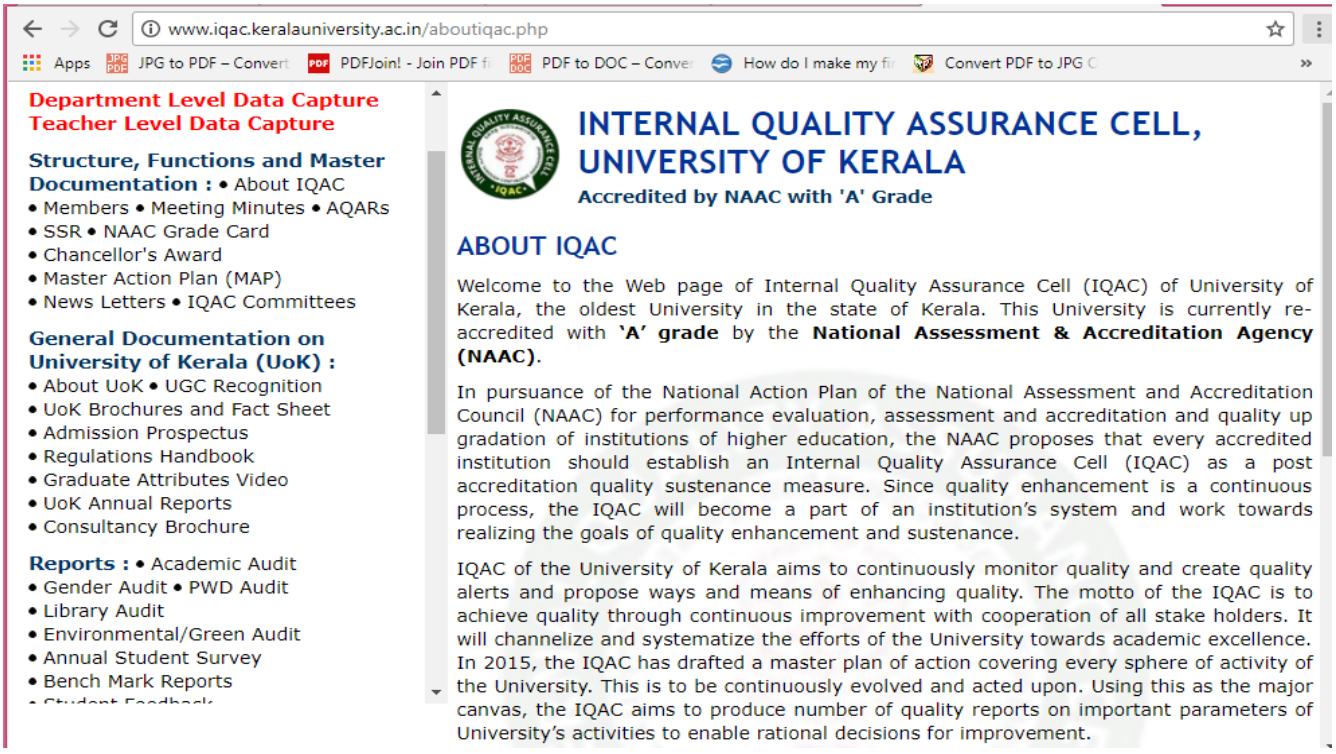
Environment/Green Audit: Environmental/Green Audit of the university has been conducted by IQAC with the help of student volunteers, Department of Environmental Sciences of UoK and also Pollution Control Board of Govt. of Kerala. By and large, the

audit reveals a healthy environment in the campus. The committee has made short term and long term suggestions to take environment protection to higher levels.

University Skill Acquisition Programme (USAP): ASAP (Additional Skill Acquisition Programme) training is available to students at higher secondary level and undergraduate level. At Post Graduate level, the need for a next level of skill development is felt. Additional skills should be imparted so that students develop themselves not only as a generation of employable work force but also acquire higher levels of academic, social & cultural skills required for overall development as a scholar and human being. Foreign language education will be one of the main focus of USAP. Being a part of globalized world, the relevance of training in foreign language is obvious and well understood. Under language skills, Russian, German, Sanskrit, Hindi, Arabic, Spanish, Chinese, Tamil, Malayalam, French and Japanese are planned. Skills that are related to academic, social and cultural development include: Personality Development, Team & Leadership Skills, Healthy Food, Creative & Critical Thinking, Music Appreciation, Yoga, Technical Writing, Chess, Magic, Public Speaking, Basic IT Skills, TV News Reading, Gandhian Thought and Digital Photography. During the Annual Student Survey, 90% of students have expressed interest in more than one USAP course.

A Multi-disciplinary Research Platform (MARC): MARC 2015, the first multi-disciplinary annual research conference organized by IQAC in collaboration with various schools of the University, was held successfully from 15-18th December 2015. Its plenary session which saw four luminaries and an audience strength of 1500, nine school level conferences which saw 343 paper presentations with 2131 registrants. Sri. T.M. Krishna, Carnatic music vocalist spoke on "Music, Science and Society". Prof. Y. S. Rajan, distinguished Professor, ISRO, Bengaluru spoke on "Technology: Challenges Ahead". Sri. P Radhakrishnan, Astro-naut, ISRO spoke on "Science and Man" and Dr. Sebastian Paul spoke on "Media and Society". The students of Dept of Music sang the University invocation song. School level conferences were held during 16-18th at various venues in which faculty, re-search scholars and students presented papers and participated. The School of Business Management & Legal Studies organized conference on the theme "Ethical & Legal Stud-ies". (40 papers were presented, 200 participated). School of Indian Languages organized conference on the theme "Relevance of Humanities in multidisciplinary research with special reference to Language and Literature"(104 papers were presented, 267 participated). The School of Life Sciences organized conference on the theme "Changing Perspectives in Life Sciences" (70 papers were presented, 400 participated). School of Communication and Library Science organized conference on the

theme" Information Overload in the Postmodern Society" (17 papers were presented, 102 participated). The School of English and Foreign Languages organized conference on the theme "Translation Studies" (35 papers were presented, 120 participated). School of Earth System Sciences organized conference on the theme "Current Trends in Earth and Environmental Research" (13 papers were presented, 100 participated). School of Technology organized conference on the theme "New Trends and Advancements in ICT" (15 papers were presented, 217 participated). School of Physical and Mathematical Sciences organized conference on the theme "Challenges in Basic Science Research" (14 papers were presented, 225 participated). School of Social Sciences organized conference on the theme "Constructing Modern Kerala: Multiple Trajectories of Past and Present" (35 papers were presented, 500 participated).

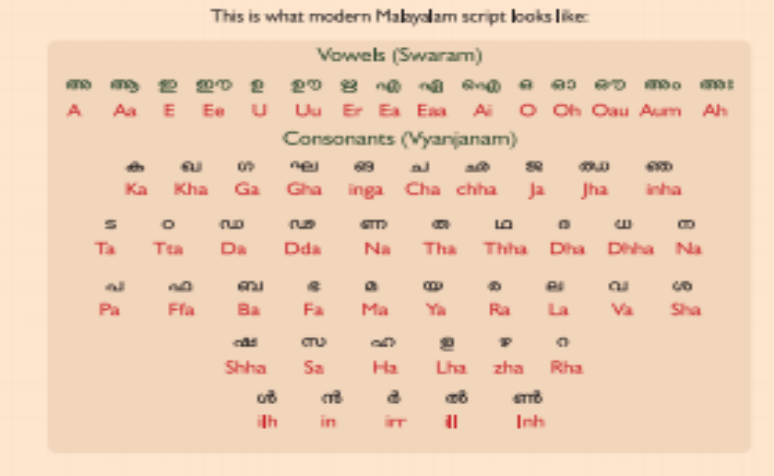


Visit IQAC Website ***at*** ***http://www.iqac.keralauniversity.ac.in***

G5. Special Information for Non-Kerala Students

Malayalam Language: Malayalam is the official language and mother tongue of most of the people of Kerala. The ***'mala'*** indicates 'hill', ***'alam'***indicates 'closeness or edge'; together means the 'place of the hills'. It belongs to the Dravidian family of languages. Reception, accommodation and convergence of different streams of people, culture and languages from different parts of the world by the people of Kerala have resulted in borrowing of phonological, grammatical features and heavy lexicons from different languages.Malayalam has elements of Sanskrit and Tamil. It is a pitch based language which makes use of retroflex sounds. Malayalam has case inflections but is not sensitive to changes ingender, number. Presence of six nasal sounds is one of the peculiar phonological features of Malayalam.

Its history goes back to 9th century AD, the first literary text is dated 12th century AD, titled Ramacaritham and the first grammar text is Lilatilakam, dated 14th century.The high rate of literacy and mass education has resulted in a vibrant literary sphere in Malayalam, with a good number of Malayalam news papers and magazines, more than any other languages in India. There exists a rich literary tradition in all genre of literature with an exceptional presence of entire current literary trends like modernism, romanticism, existentialism and post-modernism etc. It is one of the languages in South Asia in to which almost all classical literary works in the major world languages have been translated, sold and read at large. It has been granted the status of a Classical language by the Government of India. Non-Kerala students are welcome to learn Malayalam by choosing special electives/courses offered by Department of Malayalam/Linguistics.



Malayalam Survival Kit: Here are some simple phrases. Please note that many a times the English phrases (especially indicated by *) are equally or more appropriate in current times.

Afternoon	ucha	Mother	amma
Awesome	adipoli	Near	adutth
Bad	mosham	Night	raathry
Banana	pazham	No	alla
Boy	aankutty	No Problem	saaramilla
Bus	bess	Open	thurakkuka
Car	kaar	Outside	purath
Coffee	kaappi	Sir	saar
Cold	thanuppu	Slow	pathuke
Day	pakal	Snack	kadi
Down	thazhe	Tea	chaaya
Elder Brother	chettan	Thanks*	nandi
Elder Sister	chechy	There	avide
Evening	vaikunneram	Today	innu
Far	akale	Tomorrow	naale
Fast	vegam	Train	train
Father	achan	Up	mukalil
Food	aaaharam	Water	vellam
Girl	penkutty	Way	vazhi
Good	nallath	Welcome!*	swaagatham
Hello! *	namaskaram	What	enthu
Help*	sahayam	When	eppol
Here	ivide	Where	evide
Hot	choodu	Which	ethu
House	veedu	Who	aaaru
Inside	akath	Why	enthu
Left*	idath	Woman	sthree
Lunch	oonu	Yes*	athe
Man	purushan	Yesterday	innale
Me	njan	Younger Sister	aniyathi
Mine	ente	Younger Brother	aniyan
Morning	ravile		

Could I have your phone number please	phone number tharamo?
Could you please repeat in English?	englishil parayamo?
Could you show how to get to this place?	ee sthalatheykulla vazhi kanichutharamo?

Do not know Malayalam!	malayalam ariyilla !
Do you know English?	english ariyamo?
How many?	ethra ennam?
How much?	ethra aayi?
I do not want	venda
I want	venam
I am leaving	njan irangukayanu
will be right back	njan udane ethum
May I know your name please?	peru parayaamo
Numbers: Onnu (1); Randu (2); Moonnu (3); Naalu (4); Anju (5); Aaaru (6); Ezhu (7); Ettu (8); Onpathu (9); Patthu (10); Anpathu (50); Nooru (100); Aaayiram (1000).	

Local Tourism

Beaches: Trivandrum is a coastal city and has a long stretch of beaches, the most famous being the Kovalam beach. The stretch of beaches are: Poovar, Aazhimala, Vizhinjam (beach, adjacent port and harbor), Kovalam, Eve's beach, Pozhikkara (estuary), Poonthura, Valiathura, Sanghumukham, Veli, Pallithura, St. Andrews, Perumathura (Muthalappozhi estuary).

Kovalam: Kovalam is an internationally renowned beach, 12km south of Trivandrum with three adjacent crescent beaches. It has been a favourite haunt of tourists, since the 1930s. A massive rocky promontory on the beach has created a beautiful bay of calm waters ideal for sea bathing. Sunbathing, swimming, herbal body toning massages, special cultural programmes and catamaran cruising are some of the attractions. The tropical sun acts so fast that one can see the faint blush of coppery tan on the skin in a matter of minutes. The Halcyon castle, the Rajiv Gandhi Convention Centre are near the beach. The leading hotels here are the Kovalam Ashok (ITDC) built in giant terraces down the face of the cliff and the Samudra on a promontory at the other end of the beach.

Shanghumugham Beach: Shanghumugham beach is very near to the International Airport and is easily accessible from the Kovalam Beach, Veli and Akkulam Tourist Villages. The sculpture of Jalakanyaka - Mermaid is a landmark.

Azhimala Beach: Azhimala is a quiet beach near to Kovalam, around 20 km from Trivandrum city. Azhimala is known for Ayurvedic Resorts.

Chowara Beach: A beautiful beach, which can be seen from a cliff overlooking it, is a real treat.

St. Andrews Beach: This is another newly developed tourist place located near Kazhakuttom, quite close to the Karyavattom Campus.

Vizhinjam: About two km south of Kovalam, Vizhinjam is believed to have been an ancient port. Now, Vizhinjam is a fishing harbour, with a light house. The Portuguese and the Dutch had commercial establishments here. This place is being developed into an International Deep Water Container Trans-shipment Terminal.

Veli Lagoon: On the outskirts of Trivandrum (8km from the city) by the side of the placid waters of Veli lake lies the Tourist Village and Boat Club where the Veli Lake merges with the Arabian Sea. The lagoon here is separated from the sea by a narrow sand bar. An 18 acre waterfront park with a floating bridge connecting the village to the beach and a floating restaurant are the main attractions. There is an enchanting lagoon for swimming. Pedal boats, paddle-boats and speed boats can be hired to explore the lagoon.

Akkulam: Akkulam is an extension of the Veli Lake. The Boat Club operates speed, safari, pedal and rowboats from Akkulam to Veli Tourist Village. A traditional style Kettuvallam (house boat) is available for overnight stay. The swimming pool at Akkulam is equipped with glider and other playing facilities. A musical fountain is an added attraction.

Poovar: Poova**r**, 29 km from the city, beautiful place to visit, with backwaters, beaches and an island.

Pozhiyoor: The Estuary of Neyyar River, is a place to watch the river and the sea in a constant, playful battle.

Varkala Papanasam Beach: Varkala is 51 km north of Trivandrum city. The Samadhi of Sree Narayana Guru, the great social reformer and philosopher, attracts devotees in thousands. The cliffs and mineral water springs at the Papanasam beach are tourist attractions. The inland waterways system connecting Kollam in the north with Thiruvananthapuram in the south, passes through two tunnels in the hills.

Aruvikkara: This place is 16km north of Trivandrum city, gifted with lavish scenic beauty. Trivandrum city gets its water supply from the Aruvikkara reservoir. There is an ancient temple dedicated to Durga, on the rocky banks of the river.

Peppara: Peppara is 50 km from the city on the way to Ponmudi. The sanctuary there, with its rich mammalian fauna and avis is emerging as a big attraction to wild life enthusiasts and ornithologists. It was established in 1938 over an area of 53 km^2, on the Western Ghats. Elephants, sambars, leopards, lion-tailed macaques, barking deer, wild boars, tigers, nilgiri langurs and leopards are found here. The area has a variety of moths

and butterflies, and cormorants. The Peppara Wildlife Sanctuary is composed of the dense forests and the Peppara dam constructed across the Karamana River. Parts of the Palode and Kottoor reserves form part of this sanctuary. This area is dotted with large hills and numerous hillocks with forests and Eucalyptus plantations. The sanctuary is home to.

Neyyar dam: This dam on the Neyyar River is located at the foot of the Western Ghats, about 30 km from Thiruvananthapuram. It has Lion safari park, Boating, Deer park, Crocodile park, Miniature wild life sanctuary, Lake garden, Swimming pool, Watch tower and Elephant riding. A three-hour climb over the hills across the reservoir affords the thrill of hiking. There are two beautiful waterfalls on the way.

Ponmudi: Ponmudi is a hill station located 61 km north-east of Trivandrum city at an altitude of about 1000m. It is a part of the Western Ghats mountain range that runs parallel to the Arabian Sea. Kallar, situated en route to Ponmudi, is a river well known for its abundance of attractive, round-shaped boulders and pebbles. A hill tribe called Kani live in the surrounding areas. Ponmudi has a deer park.

Meenmutty Falls: This fall is one of the main attraction located near by Ponmudi hills and is around 45 km from Thiruvananthapuram city. The main attractions are waterfalls and the small natural pools and rocks located beside the way to the water fall. In order to reach the place, one has to take a long trek that passes through dense forests, upon taking special permission from the Forest Department. Facilities for trekking are available. Kombaikani waterfalls is 2km from Meenmutty.

Agastyakoodam: Agasthyarkoodam is 70 km from Thiruvananthapuram. Agasthyarkoodam is a 1,868- metre tall peak within Neyyar Wildlife Sanctuary in the Western Ghats in Kerala Tamil Nadu border. This peak is a part of Agasthyamala Biosphere Reserve. The perennial Thamrabarni river originates from the eastern side of the range. The place is famous for its abundant ayurvedic herbs and medicinal plants. Another major attraction is the Neelakurinji, a flower which blooms only once in twelve years. Agasthyarkoodam is 32 km from Neyyar Dam and 23 km from Bonacaud, near Ponmudi. The nearest railway station is Ambasamudram, Tirunelveli District, Tamil Nadu. The trekking path, nearly 35 km, is from Bonacaud. Kalakkad Mundanthurai Tiger Reserve is part of the Agasthyarkoodam range.

Kerala Museum of History and Heritage: This museum exhibits include the archaeological evidences of Neolithic age, burial urns of the Iron Age, sculptures in bronze, wood and stone, coins (the Roman Dinari, which proves Kerala's maritime contacts with the Roman Empire), 17th Century murals and Stone celts.

Tropical Botanic Garden: Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) is set up for conservation and sustainable utilization of the tropical plant genetic resources, particularly of Western Ghats. It maintains a 300 acre conservatory garden for the wild tropical plant genetic resources of the country. The Herbarium of TBGRI has 20,500 specimens of flowering plants and 10,000 of mushroom group.

Kerala Soil Museum: The museum on the premises of Central Soil Analytical Laboratory at Parottukonam, 7 km from the city, displays the diverse types of soil in Kerala. It is arguably the world's largest soil museum, which has a set of 82 soil monoliths, each 1.5 metres tall.

Kerala Legislative Assembly Golden Jubilee Memorial Museum: This museum functioning in the Legislative building, features the model of Assembly Hall, a mini theatre, research centre, multi media hall, touch screen kiosk etc.

Napier Museum, Zoo and Art Gallery: The Museum building itself is an architectural splendor (established in 1855, Chisholm, its British architect, combined Kerala, Mughal, Chinese and Italian styles of architecture in his design). The Napier Museum, the Natural History Museum, the Reptile House, butterfly park and the Shri Chitra Art Gallery are all within the Zoo complex amidst a well laid-out garden and park. There is a lake and a boat club. The Lion-tailed Macaque, Nilgiri Langur, Nilgiri Tahr, Manipur deer, Indian Rhino, Asiatic Lion and the Royal Bengal Tiger are prominent among the indigenous endangered fauna, while Giraffe, Hippo, Zebra and Cape buffalo are guests from the African region. Napier Museum houses a rare collection of archaeological and historic artifacts, bronze idols, ancient ornaments, a temple chariot, ivory carvings and life-size Kathakali dancers.

Sree Chitra Art Gallery: The Sri Chitra Art Gallery, near the Napier Museum, has on display a century old world famous paintings of Raja Ravi Varma. The gallery also has a good collection of miniature paintings from the Mughal and Rajasthani schools, Roerich paintings, paintings from China, Japan, Tibet and Bali and copiesof murals. The four hundred year old Tanjore miniature paintings encrusted with semi-precious stones are also on display at the gallery.

Magic Planet: A magic museum has been set up by the Magic Academy in KINFRA film and Video Park in Kazhakuttom very near Karyavattom.

Mitraniketan: Mitraniketan Vishwavidyapeetam for Open Learning & Total Development is a NonGovernmental organization located at Vellanad, which is 25 km

away from Thiruvananthapuram. The organization focuses on alternative education mode for development.

Koyikkal Palace, Folklore/Numismatics Museum: The Koyikkal Palace, situated 18 km from the city, was built for Umayamma Rani (17th century). The palace houses a Folklore Museum and a Numismatics Museum. The Folklore Museum is a treasure house of quaint musical instruments, occupational implements, household utensils, models of folk arts etc (Chandravalayam, Nanthuni). Wooden kitchenware, brass/copperware etc. representing the lifestyle of the Keralites during different periods, Thaaliyola (old manuscripts), Chilambu (a sort of anklet) used by Umayamma Rani and Maravuri (dress made of the bark of trees) etc. are well preserved here. Oorakkudukku a device for intellectual exercise used by the Yogis as a pastime. The Numismatics Museum : displays the coins belonging to different parts of the world, a vestige of the trade relation of Kerala in the bygone ages. Some of the oldest coins of Kerala, Ottaputhen, Erattaputhen, Kaliyugarayan Panam etc, and a Venetian coin named Amaida, believed to have been presented to Jesus Christ, is also a property of this museum. Indian coin Karsha, nearly 2500 years old, Rasi, the world's smallest coin. Rasi Palaka (the coin board) - a wooden board with small niches used to count small coins, Roman gold coins (depicting Venus, Hercules, Mars) and rulers like Hardin (AD 117 - 138) are also among the collection. The museum also has coins used by Tipu Sultan, Hyder Ali, etc.

Kuthiramalika Palace Museum: Kuthiramalika Palace or Puthenmalika (the new mansion) is situated on the south-eastern side of the Sree Padmanabhaswamy Temple inside East Fort in in Thiruvananthapuram. This wooden architectural delight was built by King SwathiThirunal. Kuthiramalika, which literally means Horse Palace, takes its name from the roof beams that are carved to resemble the faces of horses. A portion of the palace is converted into a museum which has on display paintings, ornaments and artifacts of the royal family. Swathi Thirunal's ivory throne, marble idols, Chinese artifacts and rare musical instruments are kept in the museum.

Kerala State Science and Technology Museum: The Kerala State Science and Technology Museum, established in 1984, is situated close to Postmaster General's Office in Vikasbhavan. Various engineering gallerys with educative multimedia exhibits and interactive working models are among exhibits. Priyadarshini planetarium is one of the most versatile planetariums in the country. The main GM-11 star field projector here can project almost all the constituents of the visible universe. It can also simulate the star-studded night sky over any location on the earth, on any day up to 12,500 years back or

12,500 years into the future. A part of the museum is housed in a more-than century old bunglow of British period.

Anchuthengu: Situated 40 km north of Trivandrum city, along the sea coast, Anchuthengu is a place of historic importance. It was here that the first settlement of the English East India Company was established in 1764 A.D. The remains of the old English Fort, which had withstood many a siege, can be seen here. There is an ancient Christian church in Mampally, which was built in 15th century by St. Francis Xavier. From here one can sail across the river to Veli by boat.

Balaramapuram: Balaramapuram is famous for its hand-spun cloth. Weaving is a cottage industry here as a cooperative activity. One can see traditional weaving mills in use here. It is 13 km south of the city towards Kanyakumari on National Highway 47.

Neyyattinkara: Neyyattinkara is an ancient town, situated about 20 km south-east of Trivandrum city is situated beside the bank of Neyyar River. In the premises of the temple, there is a historic jack tree, known as Ammachi Plavu, in the hollow of which King Marthanda Varma is believed to have hid himself and escaped death at the hands of his enemies. Aruvippuram is about 7km from Neyyattinkara and 24km from the city. A Siva temple founded by Sree Narayana Guru attracts a large number of worshippers during the Sivarathri festival.

Madavoorpaara Rock-Cut Temple: Madavoorpaara,an ancient rock-cut cave temple, which is about 4km from the Karyavattom Campus. A 1300-year-old cave temple, a perennial stream forming a small pond,and the enchanting view from the 600m tall hill are the attractions.

Vizhinjam Rock-Cut Temple: Perhaps the oldest historic monument in Trivandrum city - the rock temple in Vizhinjam, from the Ay Dynasty period, now under Archeological Survey of India.

Thirumala Rock Temple: Thirumala is on the Kattakkada – Neyyar Dam Road, about 6 km from the city. An ancient temple called Paarakovil (Thrichakrapuram) exits on top of Thirumala hill. Panoramic view of the city can be seen from here. The large piece of rockslab used in Sree Padmanabha Swamy Temple was cut from here. On the way one can see Vazhiyamabalam (old travellor's rest house).

Chempazhanthy Gurukulam: This a village (close to Sreekaryam) is about 7 km from the city towards north all about same distance from Karyavattom Campus, towards south. Sree Narayan Guru, saint and one of the most successful social reformers of the state was born in the small thatched hut "Vayalvaram", which is maintained intact in this place.

Santhigiri Ashram: Santhigiri Ashram is a renowned spiritual center founded in 1964. Santhigiri Ashram has been following a three-pronged philosophy of giving free food, spiritual knowledge and holistic healthcare to the masses. The ashram is also home to the Lotus Parnasala, a lotus-shaped marble monument dedicated in memory of its founder.

Thiruvallam: Thiruvallam is about 6km south of the city, on the Thiruvananthapuram-Kovalam road. There is an ancient temple here on the banks of the Karamana River.

SMSM Institute: This is a State owned handicrafts emporium, an ideal place to pick up ethnic curios and other articles.

Happy Land Water Theme Park: Happy Land Water Theme Park is located a few kilometers away from Thiruvananthapuram, at Vembayam. It spreads over a larger area on hillside blended with architectural and natural beauty.

Asaan Smarakam: About 10km towards the north from the Karyavattom campus, in a spacious lawn, one can see the old-style thatched-roof traditional Kerala house of Poet Kumaranasan.

Ranga Vilasam: This newly started museum inside the Fort has paintings and photographs from 20thcentury, mostly related to the erstwhile royal family of Travancore.

Christ Church: One of the earliest churches in the city established in early 19th century has a tombstone of many historic personalities, including Britishers who served Travancore.

War memorial & Martyr memorial: Both these are in the vicinity of the Chandrasekharan Nair Stadium at Palayam, the first one commemorating the martyrs of the first world war and the second, that of the freedom struggle.

Maruthamkuzhi Ana: The centuries old small dam which uses granite work to hold water can be seen at Maruthankuzhi, across the Killy river.

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DEPARTMENT OF BIO-TECHNOLOGY

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DEPARTMENT OF BOTANY

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9. *SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES*

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10. *SCHOOL OF SOCIAL SCIENCES*

DEPARTMENT OF ARCHAEOLOGY

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DEPARTMENT OF SOCIOLOGY

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DEPARTMENT OF COMPUTER SCIENCE

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Percentage of Similarity in PhD thesis in State Universities is less than 10%

SCIENTIFIC CORRESPONDENCE

Percentage of Similarity in PhD thesis in State Universities is less than 10%

Plagiarism is the most common form of academic dishonesty, including, exploiting works or ideas of others without citation and acknowledgement. The common types of plagiarism are direct, self and accidental plagiarism[1]. Good scientific measures in the research ethics can control these fraudulent practices. There are software based services such as URKUND, Turnitin, Plagtracker etc available for detecting plagiarism in manuscripts[2]. These tools are designed to support the student and researchers to self-analyze the percentage of similarity thereby alerting possibilities of plagiarism. Such software, if enforced, can drastically bring down cases of major plagiarism. However, there is no scientifically derived measures of normal level of overlap with other sources, to the best of our knowledge. Institutions or organizations which prescribe permissible limits, do not have any rationalization for their choice. Most world class Universities or Institutes (Harvard, Cambridge, IIT Delhi, IISc etc) recommended ways of avoiding plagiarism rather than prescribed limits of overlap with other sources[3,4,5]. Management of plagiarism in scholarly works is increasingly being focused in higher education institutions all over India. No major scientific study of existing patterns of similarity in scholarly writing has however been reported. This paper reports an attempt in this direction based on 487 thesis from Shodhganga INFLIBNET website. In this communication, we present the existing levels of overlap with other sources in PhD thesis, from a state University, University of Kerala, based on the PhD thesis uploaded from this University in Sodhganga INFLIBNET website. The statistics we report will be useful to rationalize any prescribed limits of overlap with other sources.

The dataset for the study was collected from Sodhganga INFLIBNET site, excluding the reference section (as it is unavoidably repeated across works). As the number of thesis uploaded were small, no sampling was attempted and the study was carried out on all 486 thesis. The thesis were grouped into three streams (I) Science & Technology, (II) Social Science and (III) Arts & Humanities. The detailed list of dataset is shown in table 1.

The software recommended by UGC-Urkund- was used to measure percentage of similarity. All results were analyzed and hits against the INFLIBNET website were discounted and the percentage of similarity reported were tabulated. Both raw mean, trimmed mean and standard deviation of observed percentage similarity with other sources were calculated stream wise. Table 2 and 3 shows the mean and standard deviation obtained without and with trimming the outliers. Trimming was used to exclude a handful of cases with skewed extreme.

Mean value plus one standard deviation ($x + \sigma$) of similarity with other sources is seen to be less than 10% in case of all streams with and without trimming of the mean. Therefore any overall percentage of similarity with other sources which is below 10% in any stream may be considered as normal by existing practice. Any overlap above 10% is fit case for investigation of plagiarism. It may be noted that thesis in non-English languages like Malayalam, German, Hindi etc are not accepted for checking by URKUND. We hope that similar studies on all- India basis will be taken up by interested readers.

Table 1: List of Thesis under Kerala University Published in Shodhganga up to 1-6-2015

Sl No	Stream & Subjects
1	Science & Technology (310 thesis)
	Physics (150), Mathematics (48), Chemistry (22), Civil Engineering (15), Statistics (13), Biochemistry (11), Mechanical Engineering (9), Botany (5), Zoology (5), Food and Nutrition (5), Aquatic Biology & Fisheries (4), Home Science (4), Optoelectronics (4), Future Studies (3), Bio-technology (3), Electrical Engineering (3), Electronics & Communication Engineering (2), Agriculture (1), Geology (1), Geography (1), Demography (1), Bio-Informatics (1), Environmental Science (1), Computer Science (1)
2	Social Science (77 thesis)
	History(12), Commerce (11), Economics (10), Sociology (8), Education (8), Political Science (7), Physical Education (6), Psychology (6), Management studies (5), Tourism (2), Islamic Studies (2)
3.	Arts & Humanities
	Malayalam (28), Library and Information Science (21), Philosophy (12), Linguistics (11), English (6), Tamil (5), Law (4), Hindi (4), Sanskrit (3), Music (2), German (1), Communication &Journalism (1)

Table 2: Mean & Standard deviation of observed percentage of similarity in PhD thesis from University of Kerala in Sodhganga site

Sl No	Stream	Number of thesis	Mean value of Plagiarism	Standard Deviation
1	Science & Technology	293	2.52	6.66
2	Social Studies	70	4.03	5.18
3	Arts & Humanities	79	1.77	3.65

Table 3: Trimmed Mean & Standard deviation of observed percentage of similarity in PhD thesis from University of Kerala in Sodhganga site

Sl No	Stream	Number of thesis	Mean value of Plagiarism	Standard Deviation
1	Science & Technology	278	1.86	2.24
2	Social Studies	65	2.94	2.86
3	Arts & Humanities	73	1.86	2.24

1. Masic I., "Plagiarism in scientific publishing." **Acta** Inform Med 20.4, 2012, pp. 208-213.
2. Garner HR. Combating unethical publications with plagiarism detection services. Urol Oncol 2011, 29, 1 pp. 95-99.
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5. Whittle S.R., and Murdoach-Eaton D.G., "Learning about plagarism using Tutnitin detection software", Med Educ 2008, 42, 5, p.528.

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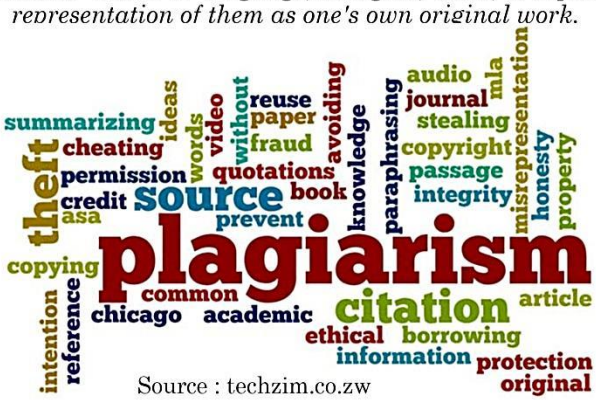
*Plagiarism, according to Wikipedia, is the "wrongful appropriation" and "stealing and publication" of another author's "language, thoughts, ideas, or expressions" and the representation of them as one's own original work.



Source : techzim.co.zw

Use UGC recommended software: Urkund !!!

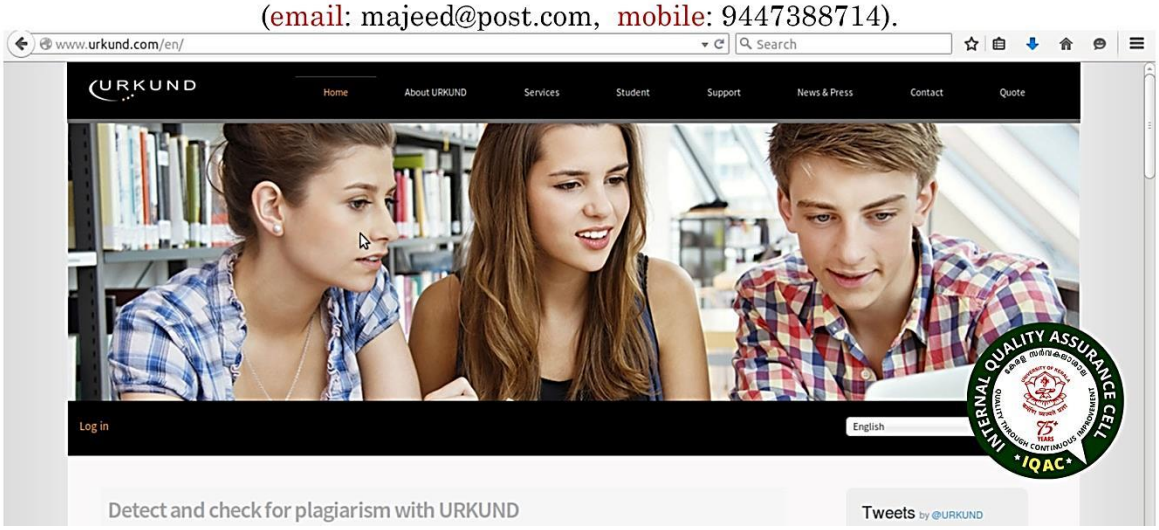
Request your research supervisor/project guide to register with URKUND and get an email ID in the format: *Adhyapakan.*Kerala@analysis.urkund.com. Simply mail your thesis chapter or assignment to the URKUND ID of your teacher and he/she will get a report in his/her regular email which can be forwarded to you. With advice of your teacher, you can then revise your text to avoid the plagiarized content.

For registering with URKUND, Teachers may contact

Dr. H. Majeed,

Asst Librarian, Kerala University Library

(email: majeed@post.com, mobile: 9447388714).



ANNUAL RESEARCHERS SURVEY 2016

An annual survey and data collection of research scholars was conducted by the IQAC in 2016. This was aimed at understanding the research practices and their social, academic, entrepreneurial, and aspirational background, so as to enable the teachers and administrators to serve them better. 30 questions were asked. The responses to these are now compiled and presented in this report. 1124 research scholars have taken part in this survey, making it a fairly representative one.

Executive Summary

64% of the research scholars do full-time research; 16% do part-time research.

62% of the researchers receive fellowships; 41% of them receive University JRF/SRF

31% of researchers have publications in 2016 with 22% having a single publication.

74% have attended atleast one conference/ seminar in 2016; 5% have won awards for conference presentations/ seminar.

Out of the science & technology research scholars, 11% have plans to patent.

61% of research scholars have used INFLIBNET, and 85% have used e-journals for references in 2016.

85% of research scholars are aware of scholar.google.com website.

88% of research scholars are aware of the issue of plagiarism, and 52% are aware of the software called URKUND.

99% of the research scholars have utilised the services of a library in 2016 – while 29% of them used their department library, 22% used the Kerala University Library, Palayam and 23% used the Campus Library, Karyavattom.

96% of researchers are happy with the progress of their reserach and 87% are happy with research facilities available to them.

88% of the researchers have established contacts with other researchers within the country, and 30% outside the country.

After completing their research, 38% plan to look for a job in college, while 32% plan to do PDF either in India or abroad.

73% researchers feel the most effective mode of communication with the research supervisor is in-person communication.

93% researchers have received enough suggestions from their supervisors for work done till date.

93% researchers follow their supervisor's suggestions to a great extent.

Type of degree

Full-time research	64%
Part-time research	16%
No response	20%

Whether in receipt of fellowship?

Yes	62%	**Distribution of those receiving fellowship**	
FDP	4%	**Fellowship Amount (Rs.)**	
No	33%	Less than 10000	9%
No response	1%	10001 – 15000	35%
		15001 – 20000	13%
		20001 – 25000	21%
		25001 – 30000	16%
		More than 30000	5%
		No response	1%
		Scheme of fellowship	
		University JRF/ SRF	41%
		UGC JRF/ SRF	27%
		E-grantz	6%
		KSCSTE	5%
		DST Inspire	2%
		CSIR-JRF	1%
		ICMR	0%
		Others	15%
		No response	3%

Present year of research

Year 1	16%
Year 2	21%
Year 3	26%
Year 4	15%
Year 5	13%
Above year 5	5%
No response	4%

Received awards for conference presentations/ science congress/ seminar/ academic competitions in 2016

One award	5%
Two awards	1%
Three awards	0%
More than three awards	0%
Nil	74%
No response	20%

Number of publications in 2016

One paper	22%
Two papers	6%
Three papers	2%
More than three papers	1%
Nil	50%
No response	19%

Seminars/ conferences attended in 2016

One	39%
Two	21%
Three	7%
More than three	7%
Nil	19%
No response	7%

If a student of Science and Technology, do you have any plans to patent?

Yes	11%
No	45%
Not applicable	32%
No response	12%

Have you used INFLIBNET in 2016?

Yes	61%
No	32%
No response	7%

Have you used any e-journals for reference in 2016?

Yes	85%
No	11%
No response	4%

Are you aware of the software called URKUND?

Yes	52%
No	41%
No response	6%

Are you aware of the issue of plagiarism?

Yes	88%
No	7%
No response	5%

Libraries used in 2016

Department library	28.8%
Kerala University Library, Palayam	22.4%
Campus library	23.1%
Libraries of other departments in the Campus	10.3%
Other libraries outside the University	15.0%
None	0.1%
No response	0.3%

Are you aware of scholar.google.com website?

Yes	85%
No	10%
No response	5%

How many times do you typically rewrite research article of thesis chapter before finalising it?

0 times	1%
1 – 5	61%
6 – 10	17%
11 – 20	3%
More than 20	0%
No response	19%

Are you happy with the progress of your research?

Yes	96%	**Percentage of satisfaction**	
		0 – 25%	1%
		26 – 50 %	11%
		51 – 75%	30%
		76 – 100%	47%
		No response	11%
No	2%	**Percentage of dissatisfaction**	
		0 – 25%	44%
		26 – 50 %	28%
		51 – 75%	12%
		76 – 100%	0%
		No response	16%
No response	2%		

Are you happy with the research facilities available to you?

Yes	87%	**Percentage of satisfaction**	
		0 – 25%	0%
		26 – 50 %	11%
		51 – 75%	29%
		76 – 100%	50%
		No response	10%
No	9%	**Percentage of dissatisfaction**	
		0 – 25%	25%
		26 – 50 %	43%
		51 – 75%	8%
		76 – 100%	2%
		No response	22%
No response	4%		

Have you established contacts with/ communicated with researchers in your field (students/ experts)

Outside University of Kerala but within India	
Yes	88%
No	9%
No response	3%

Outside the country	
Yes	30%
No	52%
No response	18%

How will your research help you?

Please see Appendix Table 1

How will your research help the society?

Please see Appendix Table 2

What are your suggestions for improving quality of research in University of Kerala?

Please see Appendix Table 3

If given an opportunity to do a short internship at an industry/ company/ R&D institution/ organisation, which institution would you wish to select? Name 3

Please see Appendix Table 4

What is your plan after completing research?

To look for a job in industry	9%
To look for a teaching job in college	38%
To look for a teaching job in school	9%
To do PDF in India/ abroad	32%
To start a initiative/ company/ organisation of my own	5%
Others	6%
No response	1%

How often do you meet your research supervisor in a month?

Every day	35%
Once in a week	34%
Twice in a month	29%
Never	1%
No response	1%

In your opinion, which mode is more effective to contact your research supervisor?

Through E-mail	14%
In person	73%
Telephone	13%
No response	0%

How often do you submit your work report to the research supervisor ?

Every month	50%
Once in three months	39%
Once in a year	10%
Never	0%
No response	1%

Did you get enough suggestions from your Supervisor for your work done so far?

Always	93%
Sometimes	7%
Never	0%
No response	0%

Do you follow the Supervisor's suggestions and make adequate corrections in your work?

To a great extent	93%
To some extent	6%
Not at all	0%
No response	1%

APPENDIX

Typical responses to open-ended questions

Table 1: How will your research help you

- Deepen Knowledge;
- Learn research methodology;
- Establish academic networks;
- Career advancement;
- Develop critical reasoning

Table 2: How will your research help the society

- Create awareness in various domains;
- Improve policy making;
- Cost-effective products;
- Eco-friendly products;
- Better management in various areas;
- Rehabilitation;
- Better facility for disabled;

Table 3: What are your suggestions for improving quality of research in University of Kerala

- Speedy administrative and paper work; Avoid official delays
- Inter-disciplinary research
- Continuous assessment of PhD
- Improve infrastructure; Improve ICT facility
- Need for sophisticated instruments and technical assistants to operate it
- Collaboration with foreign universities
- Foreign evaluation of thesis
- Need more books and e-journals
- Make researchers aware of their rights, opportunities and responsibilities, especially how the University system works – whom to contact for a particular issue.
- Make researchers aware of things like imposter syndrome and equip them to deal with stress, time management, dealing with procrastination
- Induction program for researchers – what to expect from research, the good, bad and ugly
- Stress the importance of teamwork in research – place researcher in groups of 10 including Post-docs and Guide and work on a mini-project.

Table 4: List of organizations students from University departments would like to go for internships

Science and Technology Departments	
Future Studies	**Computational Biology and Bioinformatics**
ASCoR, Amsterdam	A-Star, Singapore
C-DIT	Adhesives Research
CCNR,Boston	BIOCON
CDAC	Broad Institute, UK
CDS	Cambridge University
Center of Energy Study, IIT Delhi	CCMB, Hyderabad
CPPR	Dept. of Biosystems Science and
DSE	Engineering, Switzerland
DTU, Copenhagen	DNA Nexus
Energy Science Dept. , IIT Bombay	DRDO, Delhi
GIFT	EMBL-EBI, UK
Google	EPFL
IGIDR, Mumbai	IISC, Bangalore
IIM	IISR, Calicut
IIMK	IIT, Madras
IIT, Madras	IIT,BOMBAY
IISc, Bangalore	IIT
ISI, Kolkata	Institute of Bioinformatics, Karnataka
JNU	Institute of System Biology, Washington
MIT Media Lab	International Audio Laboratories Erlangen
National Institute of Wind Energy	JNU
NIC	Marshall Centre of Infectious Diseases,
NIPFP	Australia
NIWE, Chennai	Max Planck Institute
NREL, USA	NICED, Kolkata
OPHI	RGCB
Planning Board	Roche, Switzerland
TIFAC,New Delhi	SciGenome , Kochi
TIFR, Mumbai	SCTIMST, Poojappura
TISS	Silver lab, Harvard Medical School
UN	Underwriters Laboratory
V V Giri Labour Institute Noida	Wellcome Trust Sanger Institute, UK
VSSC, TVM	Yale Centre for Genomic Analysis, USA

Biochemistry	**Demography**
BioCon	CDS, Trivandrum
CCMB	Centre for population and development studies, Harvard
CDRI	Centre for population health sciences, Edinburg
CFTRI, Mysore	ICDS
CIFT	IEG, Delhi
CTCRI, Sreekaryam	IIPS, Mumbai
Hyderabad University	ISEC, Bangalore
IISc	JNU
IIT	National family planning
MDRC, Tvm	PHFI
NCBS	Southampton University
NIIST	TISS
RCC	Tribal development board
RGCB	WHO
SCT	
SCTIMST	
TBGRI, Palode	
TIFR	
Chemistry	**Aquatic Biology and Fisheries**
CSIR	ARI, Pune
Gulf University of Science & Technology, Mishrif, Kuwait	California state polytechnic university
IISc, Bangalore	CIBA
IISER, TVM	CICFRI
IIST, TVM	CIFA
IIT, Bombay	CIFT
IIT, Kharagpur	CMFRI
IIT, Madras	CSIR-IITR, Lucknow
IIT, New Delhi	IISc
ISRO	IMTECH, Chandigarh
JNCASR, Bangalore	Indian Institute of Toxicology, Pune
NCL, Pune	Industry
NIIST, TVM	JNCASR
RGCB	KSBB
SCTIMST	National Museum, Wales
University of Hyderabad	NBA
VSSC	NBFGR
	NIIST, TVM
	NIOT
Statistics	R & D

Planning commission, Govt. Of India Economics and statistics department Centre for developmental studies	Sriram Institute for Industrial Research Universidad de cadiz, Spain Zoological survey of India
Zoology Dept. Zoology, Karyavattom Himalaya IARI, Delhi Johnson & Johnson Kerala Agriculture University, Vellayani Loreal NIIST, TVM RGCB SCTIMST, TVM Tamil Nadu Agriculture University TBGRI UoK	**Botany** Agriculture University, Mannuthy BSI CEPCI CSIR-NIIST CTCRI Dept. Of Botany, Karyavattom Himalaya Drug Company IISER, Vithura JNTBGRI KFRI RCC, TVM RGCB Sree Chithra Bio Medical Institute
Mathematics CUSAT IISc IISER IIST IIT ISRO Kerala University NIST VSSC	**Physics** BARC IISc, Bangalore IIT, Bombay IIT, Madras NIIST, TVM RRI, Banglore TIFR, Mumbai
Computer Science CDAC E & Y GE, Healthcare Google IBS IIITMK, TVM IIIT, Banglore IIT, Madras Infosys Microsoft NIT, Calicut RCC, TVM SCT	**Biotechnology** Central Bee Research Institute, Pune Central University of Kerala CESS CFTRI CSIR-NIIST CTCRI Honey Bee Research and Extension Lab, University of Florida IISc, Bangalore IISER NBRC, Manesar NCBS, Banglore RGCB

Senseforth Siemens Subex Tata Elxsi, TVM VSSC	SCT
Geology	**Nanoscience & Nanotechnology**
Adelade University, Australia ARI CESS CGWB CWRDM IISc NCESS NGRI NIO PRL Wadia Institute of Himalyan Geology	IGCAR IISc IISER ISRO JNTBGRI National Physical Laboratory NIH, USA NIIST RGCB Tata Motors Thomson Reuters VSSC
Optoelectronics	**Environmental Sciences**
BARC BRBNML, Mysore C-DIT CGCRI IGCAR IISc, Banglore IISER, TVM IIST, TVM IIT, Delhi IIT, Madras IIT, Mumbai IMD ISRO NCESS NDL NIIST NTU, Singapore R & D Institution Regional research laboratory RGCB RRCAT, Indore RRI, Banglore	BARC, Mumbai BIS CMFRI, Kochi CPCRI CWRDM Dept. Of Environmental Science, UoK Groundwater Board IISc IIST, TVM Indian Institute of Toxicology Research, Uttar Pradesh IPCC JNTBGRI Kerala Agricultural University KFRI KMML, Kollam MOEF NIH, Roorkee NIIST NRSC, Hyderabad RGCB School of Environmental Sciences, JNU

SCT SCTIMST TIFR, Mumbai VSSC	STRI, USA Teri University, New Delhi ZMT, Bremen, Germany
Social Science Departments	
Sociology	**Psychology**
Amnesty International Central Advisory Board of Education, India CDS Central Ministry of Women and Development CGS Central Institute of Education Technology Centre for Science and Environment Gulati Institute of Finance & Taxation HelpAge India IGIRTADS Indian Institute of Education Indian Institute of Ecology and Environment KSWC NCERT Nirmala Niketan NWC SCERT Teaching institution TISS, Mumbai UN Women UNEP WHO	Ambedkar university, Delhi Child rights agencies Child welfare committees DRDO Fine art institution Gujarat Forensic Science University HLL IAF ICCONS ICDS IIT IIT Kanpur ISRO JNU Kochin refinery Lalitha Kala Academy Media Mental health centres NCERT NIMHANS NISH NUS, Singapore RCC SCERT SCTIMST Special schools Teach For India Technopark TISS, Mumbai Vizhinjam Intl Seaport VSSC Women protection
Law	**Islamic Studies**
Any educational institution in US CDS	NGO programs MWCD

Internship with judges and advocates Educational Institution Kerala Institute for Labour Employment Mohan Foundation Mritasanjeevani Murthi & Murthi National Organ & Tissue transplant organisation (NOTTO) NGO Private company Public sector company R & D TSS	
Political Science Administrative Reform Committee Amnesty International ASPIRE, UoK CDS, TVM Central University of Kerala Co-operative banks Cultural organisation Dept. Of Fisheries, Govt. Of Kerala Govt. Departments - Central or State IDSA Indian Institute of Parliamentary Affairs Institute for Defense Studies and Analysis Institute of Chinese studies Institute of peace and conflict studies, New-Delhi ISEC, Bangalore JNU, Delhi KILA MG University Ministry of external affairs Niti Ayog NMF Observer Research Foundation, NewDelhi Planning Board Prajwala PRATHAM R & D Institution	**IMK** AGS office Ananthapuri hospital Automotive manufacturing hub Banking institutions Big bazar Department of electronics and communication technology ECSB EDP cell IIM, Ahmedabad IIM, Kozhikode Infosys Kerala Start-up mission Lulu National e-governing department Niti ayog R & D Institution Reliance Retail SBI Secretariat Taj Vivanta, Mumbai Technopark

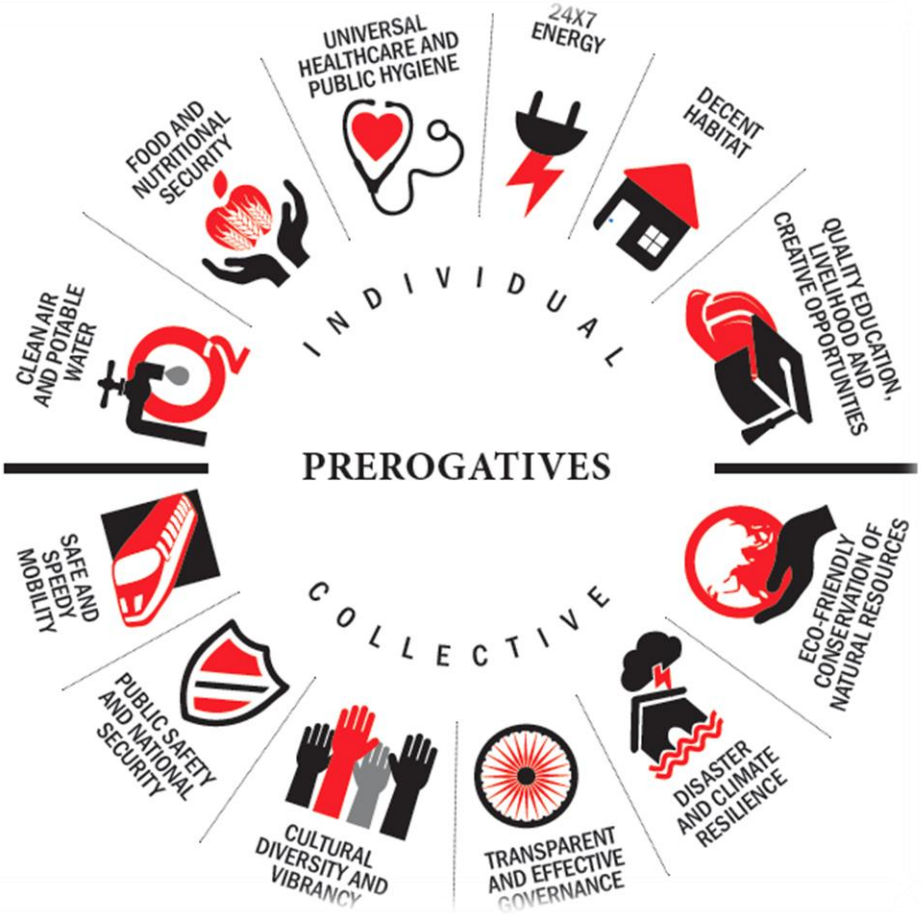
TBA21, Vienna UNICEF	
Education Brain Research Institute, Lucknow Centre for curriculum development DIET Hospital IIT Minority Institutions NCERT NISH, Akkulam NUEPA RMSA SCERT School SIEMAT Teacher Education College	**History** Aligarh Muslim University Banaras Hindu University FLAIR HCU ICHR IIT JNU, Delhi KCHR National Archives, Delhi ORI & ML, UoK Research Institution
Commerce BSE & NSE Capstock, TVM Cochin Stock Brokers Ecotourism Research Institute, Pune Hedge Equity Hitotsubashi University, Japan IIC, Kollam IIM, Banglore IIM, Kozhikode IIM, Lucknow Infosys ISRO JNU, Delhi NSDL & CDSL Public Administration Department R & D at RBI, Mumbai RBI SEBI Teri University, New Delhi	
Arts and Humanities Departments	
Library and Information Science CDAC CDS, TVM	**Linguistics** Bethel Bible College, Kollam Birmingham University

CSIR-NIIST, TVM DRDO, New-Delhi DRTC, Banglore EFLU, Hyderabad IARI, New-Delhi IISER IIST, TVM ISRO Kerala Road Fund Board KSCC KSRTC Malayalam University NISCAIR, New-Delhi Shell Oil Company Tata Institute of Fundamental Research, Mumbai TCS VSSC	Cambridge University CDAC CDIT Central Institute of Indian Languages Centre for Study of Indian Diaspora, University of Hyderabad CIIL, Mysore Diaspora Centre, IGNOU Dravidian Linguistics Institute, TVM E & Y EFLU, Hyderabad Film Academy Iccons Hospitals IIITMK, TVM IIT, Hyderabad Industry/ Organisation JNU, Delhi Lancaster University Leeds University MIT, USA NISH, Akkulam NTM, Mysore Oxford University R & D Institution Senseforth Subex UCL, London
English Australian University British Library, London Central University Centre for Women's Development Studies, Delhi EFLUE Film and Television Institute of India, Pune Hyderabad Central University IIAS, Shimla JNU Naz Foundation PU Tata institute of Social Sciences, Mumbai	**Malayalam** Calicut University Kannur university Kerala Kaumudi Kerala University Malayala Manorma Malayalam University Mathrubhumi Daily MG University Press Institutions Sree Sankaracharya University, Kalady Various language and literature institutes

ORI & ML Any R & D Institution	**Philosophy** Cambridge University CSAIL Hyderabad Central University JNU, NewDelhi Kerala University Mind Research Institute, USA Oxford University PondicherryUniversity Princeton University,USA The Mind Research Foundation, Chennai
Hindi CDAC Infosys Technopark	**Arabic** Al-jaliyath Aljaseera Channel Arabic journals BBC Arabic Consulate Curriculum Agencies Embassy-Arab countries

Inputs on Research from Industries & Other Stakeholders

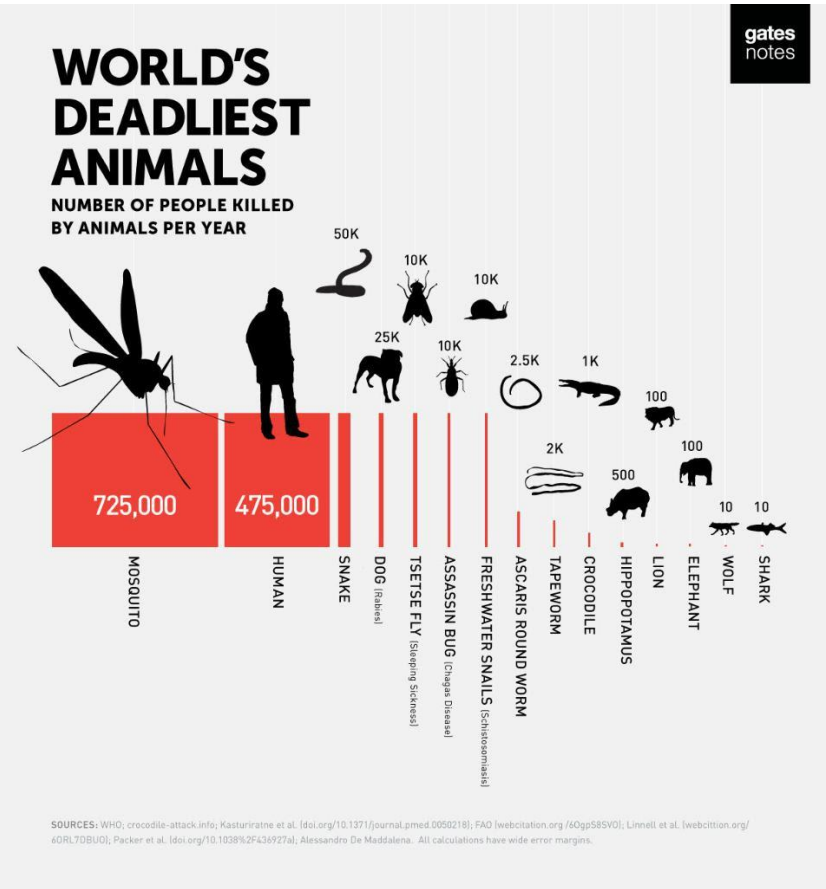
University of Kerala



Internal Quality Assurance Cell (IQAC)

University of Kerala

2016



Inputs on Research from Industries & Other Stakeholders

The University of Kerala has been accelerating its efforts to enhance quality in all spheres. This compilation is an important activity in that direction, aimed at connecting research to real-life problems. The Internal Quality Assurance Cell (IQAC) of the University has taken multiple steps to invite suggestions from all stake holders of the University, from general public, alumni, local and national Industries and organizations through direct communications, media releases and also using social media. Those have now been compiled and edited. It is now being published for the benefit of students & research scholars of our University. Many of the problems highlighted by the proposers are worth first consideration by researchers as their utility is automatic. Kerala Minerals and Metals has, for instance, pin-pointed their problem-that of developing means of using the two lakh metric ton of waste iron oxide and ETP (Effluent Treatment Plant) solid. The TCS Innovation Lab has proposed a collection of exciting technological problems. Many other organizations and individuals have made innovative suggestions regarding synthetic blood to attract mosquitos, coco-pistol to estimate tenderness of coconuts and so on.

Science & Technology Stream

DR. FEBI VARGHESE, MANAGING DIRECTOR, KERALA MINERALS & METALS LTD.

Presently KMML is doing research works in the areas including management/utilization of solid waste generated. KMML would like to further pursue these research initiatives in tune with the objectives such as

Disposal and value addition of ETP solids, Disposal and value addition of Iron Oxide, Separation and Recovery of Cyclone solids, Utilization Synthetic Rutile fines, Development of new pigment/product development, Plant scale production of nano Titanium Dioxide, Titanium Oxychloride, Process improvements, cost reduction measures, Finding end users of the above by products etc.

The disposal of ETP solid and Iron oxide is a serious issue and already we have above 2 lakhs MT of iron oxide and ETP solid in our secured ponds. Moreover, 50MT of ETP solid and iron oxide are generated per day. KMML is exploring ways and means for disposal of these solids.

For this, in addition to in house R&D research works, collaborative projects are undergoing at various reputed institutions. The major collaborative works are (i) Utilization of ETP solid and Iron oxide in Cement manufacturing: M/s National Council for Cement and Building Materials (ii) Utilization of iron oxide in Secondary steels: M/s National Institute of Secondary Steels Technology (iii) Utilization of iron oxide: M/s National Metallurgical Laboratory (iv) Utilization of ETP solid in concrete bricks: M/z Vellore Institute of Technology (v) Utilization of ETP solid in building materials: M/s T.K. M. College of Engineering.

ROBIN TOMMY, INNOVATION HEAD, TCS INNOVATION CENTRE

Here are some Problem Statements for consideration of Kerala University Researchers:

1. **Understanding the Brain**: What is the normal brain activity of a healthy human being for various situations? The situations are simulations for actual activity and mapping the brain signals for understanding the EEG. These EEG signals are learned for similar situational behavior and finding out the uniqueness using machine learning. The situation needs to cover normal emotional spectrum of human though meter. The thought meter needs to be plotted later and understood for the scenario. The study can be used for understanding criminal behavior, correct action behavior research, etc...: Technology Stream: Neurosensor, Artificial Intelligence and Bigdata.

2. **Crop Growth**: Observing the plant growth and checking the health of a plant is a very important activity today. Research is required to automate and understand the health of a

plant by continuous observation of a plant (farm extensively) and finding out the manifestation of plant life.

Problem Statements: (i)Issues found in the plant during its growth including the diseases and insect attack. (http://www.thegardenhelper.com/troubleshooting.html) (ii)Observe the leaves and predicting the harvest time based on the growth. Flowering period analysis.

Technology: Image processing, IoT, AI and Bigdata.

3. **Ergonomics Chair Initiative**. Creating a self-assembling chair for taking care of the back posture of humans. The chair should be supporting the lumbar. The chair should be smart enough to inform the user if the posture is not proper and provide the right suggestions. The lumbar support of the chair should be auto adjusted. The system also should have sedentary analysis embedded. **Technology:** Product Design, Embedded Systems, IoT.

4. **Understanding the emotions:** The airline industry would like to understand the emotions of its customers while the flight is getting delayed. The authorities needs to understand change in emotions and provide suggestions to improvise suggestions.

5. Water bed identification-Geography: Identify the ground water reservoir availability in a specific region. The water availability should be predicted for making sure enough amount of water is made available during the dry summer season. There should be mechanisms to predict the usage of water from a geography perspective and predict the total amount of water to made availability on an yearly basis.

6. Electricity consumption: Understand the total electricity consumption and also predict the average consumption required for a particular geographical region. Also the wastage of electricity needs to be understood based on the leakage analysis.

CocoPistol[18]: Tender coconut stalls often have no idea of the tenderness of the coconuts until they cut open and until the buyer tastes, sometimes we get totally un-sweet water, sometimes the tenderness is not there, it is almost mature coconut. Maybe even when they pluck, they are not very clever at identifying the lot which is just ready (or is it that they cheat once in a while). Coco Pistol would be a small hand-held pistol which could be held on the husk and shot, wherein radar like operation in it will find out the ripeness in months and display it as a digit somewhere on the pistol. This could be used before

[18] Courtesy: *Compilation of Socially Useful S& T Projects by KSSP, authored by Deepak P and Achuthsankar S Nair, 2008*

plucking the coconuts, or be provided by the sellers to the customers to choose the nut they want.

DR. M. P. ESWARA SARMA, PRINCIPAL, VAIDYAARATNAM P.S. AYURVEDA COLLEGE, KOTTAKKAL

Improving Research & Innovation through University-Industry Linkage-Suggestions

1. I, Welcome your initiative in this regard and consider this as a matter of extreme importance and value to the society
2. Ayurveda sector has been flourishing in our nation in the educational area since long time. The last century had witnessed similar flourishment in the industrial sector too. Needs and priorities of day-to-day Ayurveda have been re-defined since then. The current trends in the Ayurveda industrial sector needs to be studied in depth and a KAP analysis of major parties involved in the educational sector can be done to identify the gaps in the knowledge.
3. Bio-technology has grown in large in the modern medical sector. But, sadly, the growth of bio-technology has not been incorporated into Ayurveda sector much. This also can be considered as an area of interest.
4. Ethnic groups having long tradition in Ayurveda are in the verge of extinct. WHO had proposed ethnographic designs in researches in this field. University can take up this challenge and conduct and conduct documentation of ethnic practices and aid the traditional sector.
5. Students learning Ayurveda and young practitioners of Ayurveda need to be supported via different orientation programs so as to enable them to take up challenges in managerial, health provider, communicator and researcher roles. University can provide them opportunity By starting short-term courses in the same.
6. Different classes in the employment sector of Ayurveda Industry are in most cases not well-sensitized regarding the basis of Ayurveda and this need not addressed.
7. Tourism industry has been milking different aspects of Ayurveda, but till now a standard operative procedure on Ayurveda practices in tourism has not been developed. Kerala should show the path in this regard by framing proper guidelines.

Understanding and Predicting "Chakara"[19]: Chakara, the unique phenomenon of fishes coming close to the coastline in Kerala has not been well-studied. Currently ocean researchers depend on costly buoys to monitor ocean parameters. Satellite data is

[19] Courtesy: *Compilation of Socially Useful S& T Projects by KSSP, authored by Deepak P and Achuthsankar S Nair, 2008*

available for certain extent, however not suitable for micro level analysis. Often the costly instruments and metal parts are stolen from buoys placed in the ocean. Another way of data collection is through cruises, whose costs are very high and require human presence in the ocean. The unique challenge would be to utilize a neural network or related mechanisms to take these incomplete data and use it to predict Chakara.

DR. P. G. LATHA, DIRECTOR, JAWAHARLAL NEHRU TROPICAL BOTANIC GARDEN AND RESEARCH INSTITUTE

Jawaharlal Nehru Tropical Botanic Garden (JNTBGRI) and Kerala Forest and Research Institute (KFRI) are the two premium research institutes functioning under the Kerala State Council for Science, Technology and Environment (KSCSTE). Both these institutes are mainly engaged in conserving our rich biodiversity and its sustainable utilization in terms of developing new process, products, technology transfer, etc. The major R&D programmes currently operating in these institutions are

a) Systematic documentation of Traditional Knowledge associated with biodiversity especially plants used for food and medicine.
b) Process/Product development based on conducting preclinical and clinical trials.
c) Patenting, technology transfer, commercialization and benefit sharing.
d) Bioprospecting of plant genetic resources
e) Chemical prospecting of potential plant species
f) Biotechnology based R&D programmes
g) Development of bioinformatics and database packages
h) Studies of population structure and gene flow system of endemic plants, reproductive Biology of RET species
i) Forestry science by standardization of propagation techniques, evolving bio-control of pests and pathogens, productivity improvement, plantation technology etc.
j) Species recovery programmes
k) Bamboo and Rattan research
l) Forestry science by standardization of propagation techniques, evolving bio-control of pests and pathogens, productivity improvement, plantation technology etc.
m) Phylogenetic, evolutionary and bio geographic studies including molecular aspects of microbes, mushrooms and flowering plants.
n) Studies related to conservation biology
o) Research on Orchid biology
p) Tissue culture and mass multiplication techniques

It also suggested that University may conduct a workshop involving the representatives from various research organizations/ industries with a view to develop a road map on the subject to work out the future action plan.

D. MANMOHAN SHENOY, GENERAL SECRETARY, KMPA, KERALA MASTER PRINTERS ASSOCIATION

Kerala Master Printers Association (KMPA) is an affiliate of All India Federation of Master Printers(AIFMP)- an official body of Print businesses in India from 1953 onwards. KMPA has been working for the welfare of printers in the state and the development of printing industry in Kerala since its formation 46 years ago.

Printing as a trade started as an art, progressed significantly by applying science and technology to it and now became a confluence of creativity, technology and science. Science and technology play a major role in successful printing, without proper understanding and efficient use of the scientific methods, print cannot be any better. As you might be aware, the basic premise of offset printing is a simple scientific principle that 'Oil and water will not mix together'. Starting from this, science is applied all along the print process and as an association of printers KMPA strongly believe that contribution from scientific community is essential for us to deliver consistent and improved print quality.

In the light of above facts and understanding, KMPA would like to know if Kerala University with its abundant source of scientific resources can help resolve some of the challenges we face. We are willing to collaborate and work actively with Kerala University in identifying, developing and implementing revolutionary solutions which can be path breaking in the industry point of view and can help to raise the standard of print industry as a whole. We can take active effort in piloting such innovations through the vast network of our member printers, many of them have invested in leading technology solutions.

K.G. SREEKUMAR, CHIEF EXECUTIVE OFFICER, STATE MEDICAL PLANTS BOARD, KERALA

Before I put forth my suggestions, I wish to inform that I totally agree with the point that the University research programmes are by and large a process of research training. Degrees are produced for degree sake with little social relevance, over duplication and spoon feeding. How many these that are produced with original thinking and innovative ideas? Less than 10%. Hence I Suggest the following points for improving the research scenario particularly on the subject mentioned above.

1. 6 months research training for PhD candidates before initiation of work. During this period the basic facts of research and Objectives of the work to be made clear. Along with this training in project preparations, Scientific administration, mock presentations etc to to strengthen the capacity of the candidates.
2. Relevant topics required by the society in the Regional, National and International levels to be selected for research work.
3. As part of University-Industry interaction, topics of interest to be selected, funded by industries which may be short term or long term.
4. Incentives to researchers if the Projects executed are a success.
5. As done in IT industries, as part of human resource development enrollment of right research candidates in industry to be looked into after making and MOU with concerned industries. This will definitely boost the morale of young researchers which is presently the main lacuna in the research field where dynamic interesting researchers quit the research field in need of proper positions.
6. Initiation of team work among researchers for successful handling of mega projects.

I hope that these suggestions if implemented will definitely make a revolutionary change in the area of research particularly in University- Industry linkage. The State Medicinal Plants Board, Kerala is already working in this line in the implementation of its various projects.

THE DIRECTOR, KERALA STATE SCIENCE AND TECHNOLOGY MUSEUM & PRIYADARSINI PLANETARIUM

KSSTM is happy to give suggestion regarding the improvement of research and innovation through University. In this regard some technical problems/suggestions are furnished as below for including the same in the research topics of the research scholars and P.G. students of University. The concerned Research Scholars, PG Students or Professors are welcome to our institutions for further discussing in the above regard.

1. A simple software/ mechanism for projection on spherical screens.
2. Perfect merging of projection of images from multiple projectors simultaneously without over brightness & with perfect edge blending
3. Paint/chemicals which exhibit phosphorescence on coating over a surface.
4. Developing polarized screen for viewing 3D images using polarization techniques.

MADAN THANGAVELU (ALUMNUS OF UOK), UNIVERSITY OF CAMBRIDGE, UK

University of Kerala: Consolidating Seven Decades of Research & Enhancing, Diversifying and Charting the Future: Greetings from Cambridge and from Bell, Eifel,

Germany, home of the European Ayurveda Association (www.euroayurveda.eu/). Very happy to be reconnecting and also to be asked to share thoughts and views on research directions for scholars at the University of Kerala. The searchable compilation of PhDs awarded (http://research.keralauniversity.ac.in /viewphd Awardees.php) also I found invaluable. I have particularly enjoyed using the Research Portal and reviewing details of Ph.D. awarded by the Faculties of Applied Sciences & Technology (Biotechnology, Environmental Sciences), Medicine (Medicine, Nursing, and Pharmaceutical Sciences), Applied Sciences & Technology (Biotechnology, Computational Biology & Bioinformatics, Environmental Sciences, and Microbiology), and Science (Aquatic Biology & Fisheries, Biochemistry, Botany, Zoology and other subjects).

Despite the many constrains on how to enable world-class research with limited budgets and resources, I feel one can still engage and generate world class research results. Perhaps the first question to enable this would surely be "How to encourage both students and staff / research guides to identify with, add to and refine the seven decades of history of research, to develop critical skills and also identify areas that link the ancient with the modern / future and areas that are particular relevant locally." As an example, starting with one of the early PhD thesis, "Studies on Indigenous Drugs." (submitted 22/06/1954) one finds easily a path to the much needed issue of <u>developing research questions.</u>

The highest priority in this direction should be find ways to explore further the theme of "Developing a Research Style that resonates and leverages the local opportunities, needs and strengths but with a Global Vision". In terms of local problems, for instance, how to enable cross-disciplinary and transdisciplinary interests - for instance a continuation of the work "Rhizosphere Microflora of Coconut Palms with Special Reference to Root (Wilt) Disease." (V. Padmanabhan Potty 16/05/1978) and linking this with contemporary research on rhizosphere microbiome. The Microbiome is a fantastically rich area of study, as you well appreciate, and touches bioinformatics and skills which are also relevant for human and animal health and also health of the environment. Innumerable aspects, perhaps even general principles could be appreciated by studying local opportunities. The virgin lands of the Western Ghats offer excellent resource for exploring this area.

The one Health Agenda in which such questions come to play, is starting to be appreciated more and more (*www.**onehealth**initiative.com, https://en.wikipedia.org/wiki/**One_Health***). Food, Exercise-Fitness and Health are all the interlinked major themes - pointing also to the important and related concepts of *ama,* described well in Ayurevda, and the gut-brain axis in etiology and pathology of chronic non-communicable diseases

as described in Ayurveda and the modern and very fast growing area of microbial metagenomics. Communication styles and systems we could not image even five years ago are already reshaping the world with each passing day. The speed and rapidity of such change will only increase. For instance, Lee Hartwell, Nobel Laureate Addresses the Convocation Gathering at Amrita University
https://www.amrita.edu/news/nobel-laureate-addresses-convocation-gathering/
Lee Hartwell 2009 Amrita University Convocation Speech, part 1
https://www.youtube.com/watch?v=4g-Usmkn1ns
Lee Hartwell 2009 Amrita University Convocation Speech, part 2
https://www.youtube.com/watch?v=5q40bUcF5S8
Lee presents well the links between environment and health.

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" One of Kerala's unique strengths is its high population density. Trivandrum District, for instance has a density of almost 1,500 per square kilometer. Such local opportunities give rise to local needs and in turn excellent research directions, for instance in human health. One theme could well be: "**Molecular and Cellular Measurements of Health and Disease**" - alluded to by Lee.

Hartwell in his address (part 1 at 6:43 and onwards). Information that can be generated here will be of use to many research projects in India and around the world. Skills available in locations like RGCB and other institutes can be easily drawn to helps large programmes of work. To capitalize on Kerala's strength and tradition of Ayurveda, for instance, how might one connect with rich concepts like the ones described in the Samhitas and played out in applications like the one for treatment of hyperlipidemia as in this document?

Snigdha and *Ruksa Guna* with special reference to *Rasa-raktagata Sneha* (hyperlipidemia)
http://www.ayujournal.org/article.asp?issn=0974-8520;year=2011;volume=32;issue=2;spage=200;epage=206;aulast=Mishra

*T*he abstract of one of the presentations later this year at the Ayurveda Congress in Koblenz offers even more possibilities: *Traditional Knowledge Innovation-Kerala (TKI-K) & Ayurveda for Diabetes: Standardising the preparation, toxicity studies and efficacy of an ancient 22-ingredient kashayam formulation detailed in Keraleeya Oushadha Vijnana.* The **Traditional Knowledge Innovation-Kerala (TKI-K)** alluded to here points one to Kerala University's rich manuscript collection awaits deeper and fuller study and also how to maintain and grow locally the Sanskrit skills and strengths.

Manuscripts like the ones from Pandalam Palace, alluded to in the abstract, makes one ask how to capitalize on Trivandrum Sanskrit Series_(TSS) by Trivandrum University Manuscripts Library (https://archive.org/details/Trivandrum_Sanskrit_Series_TSS) and its strengths and to connect with other Kerala initiatives like or connecting with Kerala Innovation Initiative. Or the Vedic Knowledge with links to the four Madhom's in Vadakkunnathan Temple , Thrissur Vadake Madhhom in Thrissur. These kinds of strengths offers opportunities for forging academic links with other universities in India - particularly ones like Jamnagar (Gujarat Ayurveda University) and Banaras Hindu University in areas like Sanskrit and Samhitas and contemporization of ancient knowledge.

The opportunities are many, and if there is one state in India that can enable all this then it surely must be Kerala and in Kerala the University of Kerala has a special role. There are innumerable other such possibilities that can be visualized that will not only turn into exciting projects of immediate relevance but also reinstall in scholars a sense of pride for the local traditions and also in turn the energy and enthusiasm to kindle such a passion in the students that will teach. Kerala has much to offer not just India but all of Mankind across the World.

I am delighted to be asked to do this exercise. I am happy to continue this dialogue and to details possible projects and opportunities for connecting with universities across India and around the Globe.

G. SREENIVASAN, KSEB, THIRUVANANTHAPURAM

Earthing: 1.Enhancing earthing properties of substation premises in KSEB using locally available materials. The earth resistance of substation should be as low as possible, preferably 0.5-1 ohm. Due to lack of sufficient land and geological peculiarity [filled land and poor conductivity], this value is seldom achieved paving way for multiple issues viz. safety, equipment failure etc.

Generation: 2. A case study with respect to the sudden damage of Arial Bunched Cable [ABC] installed at Chimney SHEP in Thrissur District. The Arial Bunched Cable in Kerala System is not capable of withstanding Short Circuit Current. The present design [eccentricity of core, size of messenger wire] causes frequent burning of carrier/messenger etc.. This has resulted into huge loss to exchequer-.

3. Evaluation of commercial worthiness of SHP in Kerala. SHPs do not follow merit order depatch system where the costly machine has to be switched off when cheap power is available. If SHP is awarded to Independent Power Producer [IPP], the commercial impact on KSEB would be high. A solution is yet to arrive.

4. Mitigation of challenges in Renewable Energy [RE] integration-A model to finalize the requirement of spinning reserve. The implementation of Solar Power is gaining momentum and moving in uncontrollable way. Govt. of India has envisaged addition of 175GW by 2022.Also, various regulations have come up compelling utilities to incorporate 8% of their consumption from RE as Renewable Power Obligation[RPO]. Technical issues of RE integration is a challenge for utility as no reactive power is supplied to grid- Engineering solution is very much required with respect to requirement of spinning reserve.

5. Electricity generation from municipal waste- Development of appropriate model for Kerala Scenario. Electricity from waste has not been developed adequately in Kerala due to high Humidity and unsegregated waste., thereby efficiency of process becoming less. Segregation of waste and processing has been flourishing in Europe – Many models adopted here have become a failure. Development of appropriate model for Kerala Scenario in the context of high volume of food waste among South Indians.

Power Theft: 6.A solution to power theft caused by Electrostatic Devices [ESD]-The energy meters are designed based on IS and CBIP Standards. One of the high- tech power thefts is by applying electrostatic voltages to meter, making it temporarily/ permanently out of order and leaving no physical evidence. Researchers have come out with Sensors having high immunity to ESD and communicate to data centre on which utility can act upon later. But R&D should develop to design meters which can act as deterrent to ESD itself. A Solution is yet to be developed globally. This is very important as 1% of GDP in India is lost by way of power theft.

7. Correlation of over reacting high responsive community in Kerala and Power theft – Establishing a relationship. It has been observed that high responsive communities indulge more in committing crimes.

8. Power Theft- Establishing relationship between the undue benefit enjoyed by industrialist [Ice Manufactures of Kerala] and Power Theft, through unfair industrial competition and its Social impact. Electricity is the main "Raw Material" for Ice plants. They resort to power theft to get competitive prize for Product. The effort of Govt. of Kerala and KSEB for DSM activities has failed since only 5 % companies followed Energy Conservation & DSM activity, though payback period is just 1month. There were 1400 ice manufacturers in Kerala, now reduced to 500, remain competitive in field mainly through their flair to circumvent any action by authorities against this silent crime.

9. Power Theft- Social Stigma of Consumers trapped by organized Power Theft Performers-A study

Power Theft is a criminal activity invites up to 5 years imprisonment. Organized criminals professionally undertake power theft causing lifelong Social Stigma to consumers who are otherwise honest and unaware of the severity of the issue. The law is very strict as theft need not be caught red handed and performer escapes and consumer got punished as benefit of doubt is towards prosecution in this case.

10. Power Theft -A Study on the detection Vs Conviction of Power Theft cases – Issues associated in the prosecution problems in Kerala.

11. Power Theft -Media avoidance of Power theft related stories of corporate business establishments. A study to expose the unholy nexus between two corporate.

12. Techno-economical impact of domestic inverters in Kerala. A continuous load of 50-150 watts per inverter is thrust on the system –It is estimated that 10 Lakh inverters are functioning in Kerala, of which majority are unbranded causing threat to power quality and commercial viability-A cost effective model is required.

13**.**A study on mitigation measures for the harmonic pollution by solar inverters

Solar Inverters are sources of both Harmonic Voltages and Harmonic current creating severe impact in System. This is absent in foreign countries where solar integration is in HT and usually would be with two grid, based on priority. A study and mitigation measures for the harmonic pollution by solar inverters would be beneficial as more and more solar schemes are in the offing.

14. LED Lights and Cornea Damage – Is there any relationship? KSEB is on the process of distributing 1.5 Crores LED bulbs throughout Kerala as a part of domestic efficient lighting program [DELP] of Govt. of India. Also, retrofitting of street lights with energy efficient LED lights are in progress at few area on trial basis. Answer to '*LED Lights and Cornea Damage – Is there any relationship*?' will help a lot for the manufacturers also to alter design parameters and to society at large.

15. Harmonic injection of LED in Kerala system –An impact study and mitigation measures. LED is considered as a panacea for all lighting problems now a days. LED Driving Circuit, Retrofitted LED etc are having heavy harmonic injection -On Long Run it will affect Distribution Transformer, core heating, neutral current to increase etc. –An effective solution is required

Safety: 16. Is Extreme trade union activism the major contributing factor that causes accidents in KSEB Ltd.? The **fatal** electricity accident rate of KSEB Ltd **per month** is as follows. Staff-1, Contract workers -2, Public - from KSEB installations-3. A preliminary study on this for 18 month statistics shows that carelessness, over confidence, confidence

of being protected etc are the reasons behind this. Usually the enquiry of accidents will take years together to complete and often the guilty comes out with minimum punishment.

17 A nature friendly disposing model for 1.5 crores CFL in Kerala. KSEB has distributed 1.5 Crores [not the exact number] CFL in domestic sector about 6-8 years back. This program has been rated as one of the best in demand side management [DSM] in India. A survey recently conducted by this office revealed CFL density of 6 numbers per house. How to dispose is a challenge for utilities and state.

SABARINATH, MIT (Alumni of University of Kerala)

I wish to bring to the note of researchers in University of Kerala the MIT Initiative – Innovating for Billions: This is a phenomenal program started by a Media Lab professor Ramesh Raskar. I really love his quote, "The World is our Lab". The idea is to bring collaborative teams from around the world to innovate and define solutions that would help Billions of people. Naturally, they have multiple collaborators in India. The program is called Emerging Worlds; you can read more about it here. http://www.redx.io/emerging- worlds-1/ #emerging- worlds Please review two attached documents. Through this program, I met this Kid, a 10th grader from Nasik, who taught himself Hadoop and other programming languages, and came up with a solution for crowd counting, controlling and managing using existing cellphone infrastructure. This was piloted during last Kumb Mela I was quiet impressed by this kid. I am sure, in 10 years we will hear about him a lot.

I strongly believe, if our research scholars and faculty truly understand this philosophy, we can identify problems in our society that needs solutions affecting large number of lives. Many a times, success of research or innovation lies in collaboration and not working in a silo. Identify and forge right partnerships, its actually easier than we think. When we talk about research, it does not have to be inventing something new, does not have to be hard core scientific. It could be a solution using the tools that is available.

One of my pet peeves about our city and state is that none of the modernizations are done based on any planning or after analyzing data at hand. May be I am totally wrong. One of the examples is traffic control in the city. Do we have any mechanism to capture and analyze traffic data from different roads in the city. If we collect data, number of vehicles using a particular street at different times during the day, weekday weekends etc, couldn't we develop some smart algorithms to control traffic flow? Maybe make certain streets one-way during certain times of the day, increase number of lines in

one direction during certain times etc. Anytime these types of discussion come up we are quick to point out that this will happen only in places like US where you have wide highways and great roads. Actually not true, doing such research will at least provide us with enough data to corroborate our arguments, one way or another.

I would like to propose a social research on why we as Indians have trouble being model citizens in our own land but would be a perfect citizen in any other land. Is this due to lack of instilling values in early childhood, what can be done? At least identify the problem. I am talking about seemingly simple issues like, standing in line, being courteous to the person next to you. Simply smiling at a stranger when you make eye contact. I am not talking about rules or punishments, in other countries rules and punishments are needed only for a very small minority, majority of its citizens grow up to be descent humans, both within their families and as citizens at large. Sabarinath, MIT

DR. P.C. DIWAKAR, SCIENTIFIC SECRETARY, INDIAN SPACE RESEARCH ORGANIZATION, BANGALORE

ISRO has closer interactions with the academic institutions including your esteemed University in many ways, in pursuing research areas of mutual interests as well towards indigenous capacity building in the country. I would like to highlight a few of them below.

(i) ISRO has an ongoing programme of sponsoring research in academics in India, namely RESPOND. The main objective of RESPOND is to encourage quality research in the areas of relevance to the Indian Space programme. Many Universities, including your University, have joined hands with ISRO in this Programme which is of mutual benefit. You may like to visit the URL for further details of the Programme and type of ongoing cooperation with the academia: www.isro.gov.in/sponsored-research-respond

Particularly to get an idea of areas or research proposals of interest to ISRO, you may like to see the Sponsored Areas of Research wherein a consolidated list of more than 500 projects undertaken from 2000 to 2016 are listed (www.isro.gov.in/sponsored- research-respond/ supported-areas-of-research). It should provide the wide variety of areas of interests pursued by ISRO.

(ii) ISRO/DOS has also a programme of supporting Planetary Sciences and Exploration Programme (PLANEX) administered through Physical Research Laboratory, Ahmedabad. The PLANEX programme has evinced keen interests from among the student community about research and development in Planetary Sciences and allied areas, including development of payloads for future space missions. PLANEX has also established a National Facility at PRL for analysis of astromaterials and research, which

are open to the interested students. You may like to see further details in the URL below: https://www.pri.res.in. You may like to see particularly the periodic Newsletters brought out by PLANEX to get an idea about latest: research and technological activities undertaken in Planetary Sciences to motivate the researchers. http://www.prl.res.in/~rajiv/planexnews/index.php

I am sure, the information provided in the above websites will provide you an idea of various ongoing and the planned research activities, that are of interest to ISRO, and enable your esteemed University to take up some of the topics for research and innovation.

DR. KAMALAKSHAN KOKKAL, KSCTSE

University Research scholars should see the children science congress projects. These projects are having societal applications. Univ. Research scholars should take up such projects with greater dimension on science and technology involvement on societal needs and progress. Sent from my ASUS.

DR. T. K. ALEX, HON DISTINGUISHED PROFESSOR, ISRO, BANGALORE

(Former Student from TKM College of Engineering, Kerala University: 1964-69)

As far as ISRO is concerned, there is a need for Academic Interaction to achieve the National goals. ISRO has published its areas of interest in different fields like Launch vehicle technology, Satellite Technology and Application of Space for Societal applications. ISRO has brought out these requirements in a document, which can be obtained from the office of Scientific Secretary, DOS, and Bengalore 560231. All research work need not be for immediate application. Some of them could be for understanding the fundamentals of any subject (science or engineering). It may have application, may be in the future. Wishing you all the best for this effort of interaction with all stake holders.

MAHESH KUMAR .R, VAYALARIKOM, ATTINGAL

കേരളത്തിൽ ഇന്ന് കോഴി മാലിന്യങ്ങൾ കൊ□ ് പൊതുനിരത്തുകളിൽപോലും സഞ്ചരിക്കാൻ കഴിയാത്ത അവസ്ഥയാണ്. പൗൾട്രി ഫാമുകൾക്ക് ലൈസൻസ് കൊടുക്കാൻ ആരോഗ്യ വകുപ്പിൻ കീഴിലോ മലിനീകരണനിയന്ത്രണ ബോർഡിലോ ഒരു എഴുതപ്പെട്ട നിയമ വ്യവസ്ഥകളും ഇല്ല. കക്ഷികളുമായുള്ള സ്വാർത്ഥതാത്പര്യങ്ങൾക്ക് വിധേയമായും പ്രലോഭനങ്ങളും സാമ്പത്തികലാഭങ്ങളും മാത്രം മാനദണ്ഡമാക്കിയുമാണ് ഈ പ്രക്രീയ നടക്കുന്നത്. ഈ വിവരങ്ങൾ ഇവിടെ ആരുടേയും ശ്രദ്ധയിൽപ്പെടതെ കാലങ്ങളായി നടന്നുവരികയാണ്. ഈ വിഷയം പഠനവിധേയമാക്കണമെന്നും സർക്കാരിന് ഇതിന്റെ തീവ്രത ബോദ്ധ്യപ്പെടുത്തണമെന്നും ആവശ്യപ്പെടുന്നു. വ്യകതമായ ദൂരപരിധി, ജനവാസമേഖലയിൽ പാലിക്കപ്പെടേ□ മാനദണ്ഡങ്ങൾ ഈ വിഷയങ്ങളിലുള്ള വ്യക്തമായ രൂപരേഖക്ക് ഈ വിഷയം പഠനവിധേയമാക്കണമെന്ന് അപേക്ഷിക്കുന്നു.

DR. BABOO M. NAIR, PROFESSOR EMERITUS, APPLIED NUTRITION, FOOD HEALTH SCIENCE CENTRE, LUND UNIVERSITY, SWEDEN

Most important advice I can give to the researchers of Kerala is to do research on the utilisation of organic and inorganic raw materials of Kerala to produce highly value added finished products for the global market. Not simple products and not for the domestic market!

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

Kudumbasree is promoting microenterprises for livelihood of poor women. Wide variety of microenterprises are promoted by Kudumbasree right from canteen and catering, IT, Taxi service, Infant supplementary feed, Apparel Sector, Agri and Animal Husbandry related enterprises many being upgraded to Producer Companies for economic empowerment of Women. But still we have identified some gaps in Marketing, Quality aspects, Technology updation aspects, HR Development aspects, Legal aspects etc. in Enterprises. Profitability and sustainability of the Enterprises is still a gap which affects our enterprises. We think that the Faculty of Legal and Management studies can assist us in certain areas. Also the Department of Home Science, Food and Nutrition can assist in developing the quality and shelf life of the products manufactured by Kudubasree Enterprises. Similarly the University can assist us in developing v arious projects related to women empowerment especially gender studies. Also we have certain programs/projects like Ashraya) Destitute Identification and Rehabilitation Project),

BUDS, Tribal and Coastal etc. for social empowerment and assistance of the poor and downtrodden. Students can do project studies in our Organization. Also Research scholars can study specific topics in any of our initiatives. Hence we would like to have a discussion with University of Kerala to workout strategies for Mutual collaboration and Partnership in various Projects including the scope of consultancy services. Kindly make it convenient to have a discussion on all the above possibilities on a mutually convenient date and place.

EXTRACTS FROM 10 BREAKTHROUGH TECHNOLOGIES 2016 by JESSICA SVENDSEN

Same Areas to explore

- Genetically engineered immune cells for treat cancer
- Human powered house hold devices (light, fan etc.)
- Bio sensors

Miscallaneous

Building Material (Via Social Media): Can we embed sealed plastic/aluminium cases filled with water in buildings? Can that make the rooms' cooler during summer? Can waste plastic bottles be used for the purpose?

Frugal Innovation (Via Social Media): University needs to think of simple and common-sensical solutions to problems rather than highly complicated and technological solutions. Researcher should not get corrupted by technology.

Toy Microscopes: Can we recycle used web-cams or mobile cameras in reverse to build toy microscopes for schools (Dr. R. Dileep Kumar, Post Doc Fellow, University of Kerala).

I am holding an office which is under public gate and is constantly under controversies. I am afraid if someone has planted secret cameras or recorders in my office. Also, I am afraid that some visitors carry secret cameras on them. Can the technology researchers device an instrument which if I keep in my room, it will beep if any such device is present?: **Anonymous**

Can we have a simple low cost device which will produce a beep sound in the house (i) when the overhead water tank over flows (ii) when the overhead water tank has only 10% water left. Such a device, if very low cost, has a potential to be sold in every house in Kerala: **Anonymous**

A gun which will produce ultra/supersonic sound which will scare dogs away: **Anonymous.** Resins from plants like Vatta (which was used as gum) and that of Murinja etc. need to be researched: **Anonymous**

Humanities, Arts & Social Science Stream

EXECUTIVE DIRECTOR, KERALA INSTITUTE OF LABOUR AND EMPLOYMENT (KILE)

KILE is an autonomous body, constituted by the Govt. of Kerala in 1978 for the purpose of training and research on labour, employment and allied subjects. Our emphasis is more on applied- Problem –solving type of studies with diagnostic perspectives and not on the academic type of studies guided by hypotheses and sophisticated statistical techniques. Our focus is on discovering the cause-effect relationships of the chronic problems in managing labour. Industrial relations, labour laws, labour welfare, adjudication, trade union movements- both in the industrial and the agrarian sectors, work-related problems of labour in the unorganized sector, migrant workers and the like. The other focus of the studies is the employment – unemployment sector, problems and prospects of self-employment in the Kerala context and the impact of various schemes for promoting employment. A list of major studies undertaken by us is attached here with. Some of the earlier studies have become out of date. There is need for projects on these subjects for updating the earlier findings, conclusions and solutions.

KILE has just completed a study on the "Current Status of the Coir Industry in Kerala". It was a diagnostic type of study mainly to understand the under-currents responsible for the decline of the industry. Similar studies could be undertaken on the traditional industries of Kerala such as cashew, handloom, handicrafts, plantations, bricks and tiles, match industry etc. The state governments and the State Planning Boards seek such diagnostic studies for developing schemes.

For promoting and supervising research-type of studies, KILE has set up a Core Committee consisting of experts on research methodology and have adequate budget allocations. Only Ph.D holders are eligible to submit proposals.

University Departments can take up inter-disciplinary type of studies related to various aspects of industry such as:

1. The persisting problem of industrial sickness in public sector undertakings in Kerala.
2. An assessment of work culture and work ethics among Kerala labour in terms of labour productivity.
3. The nagging problem of loading and unloading/nokku coolie in Kerala and its impact on industrial development.
4. Persistent opposition against productivity-linked wage agreements (and not time-based wage agreements which is the practice today in industries)
5. An assessment of the status of "ease of doing business" in Kerala

DR. K. AMBADY, MANAGING DIRECTOR, KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LIMITED

KSCADC is a fully owned Sate government Company for integrating the developmental activities of coastal areas. KSCADC is presently undertaken projects in coastal infrastructure developments, fisheries infrastructure development, Technology acquisition, Commercial Operation and Consultancy. With reference to the above letter, I am forwarding following suggestions which will help to create a better university industry linkage.

1. SWOT studies on fisher folk on social side.
2. Department of Aquatic Science and Fisheries can undertake realistic studies to augment the production of aquatic vegetation as well as animals.
3. Studies on market research, market analysis and marketing strategies for promotion of innovative fish and fishery products.
4. Conduct studies on types of fish aggregating devices that are most suitable along the Kerala coastal waters. Also studies on pre and post installation fishery resources available and the linked economic scenario.
5. Conduct studies on problems/factors affecting school drop outs of fishermen children and propose remedial measures to minimise such drop out and to handhold them back to mainstream education.
6. Conduct studies to minimise the cost of fishing and thus to improve catch per unit effort.

DR. RAJASHREE AJITH, DIRECTOR, KERALA INSTITUTE OF TOURISM & TRAVEL STUDIES

I suggest following research topics in tourism:

1. Product development in tourism giving focus to social and environmental settings of Kerala.
2. Developing value added products to core tourism products such as beaches, backwaters, hill stations Ayurveda giving focus to local specificity
3. Exploring niche products and niche markets in tourism
4. Facilitating accessible tourism in museums and heritage sites
5. Developing strategies for enhancing occupancy ration in accommodation sector
6. Developing Crisis Management System for properties in tourism destination
7. Developing customized software for property management system in Tourism
8. Use of IT in facilitating tour guiding
9. IT as a facilitator for interpreting museums, heritage monuments and historical sites
10. Economic linkages of Tourism in Kerala

11. Branding ethnic products for ensuring quality
12. Developing destination specific souvenirs

DR. SYED IBRAHIM, DIRECTOR, GOETHE CENTRUM, TRIVANDRUM

1. The history of Chala Bazaar and its socio-economic role today.
2. The architectural and social relevance of Agraharams in Trivandrum
3. IT Revolution and the Emergence of Technology Parks in Kerala. With a Special Reference to the socio-cultural Impacts
4. A Study of the Political Landscape on Kerala and exploring the causes of political violence in certain areas

E. R. JAYADEEP P.K, LEAD QMS AUDITOR, IRCA

Need Based Educational System of Social Significance: During my professional days as a sales engineer in early seventies, I have been travelling far and wide in India and abroad. I had opportunities to closely interact with people of various strata from porter and tea boy to managing directors and chairmen of large scale public and private establishments. In fact, I was more impressed by the common sense and skill of people at lower stratum in comparison with the rest.

I have many classic examples on this and a few are enumerated. A tea boy in an Iranian restaurant in Pune, who was from Assam, had all the knowledge on the types of teas available all over the world and their tastes, which was comparable with the knowledge of any expert tea taster. After many years I found him still in the same restaurant. He got stuck where he is! Once I suffered from a severe and unbearable stomach ache late night while staying in a hotel in Allahabad. I called up for help from room boy to take me to any nearby clinic. He asked me, what I ate for dinner and I mentioned that I had taken fresh water fish fry. He told me to wait for a few minutes and he went to his house nearby and brought some fresh leaves which he told me to chew, which I did hesitantly. To my surprise, the pain had totally vanished in a few moments. loved to eat mangoes cultivated by Adivasis in a plantation of five thousand acres of forest land in Karim Nagar district of Andhra Pradesh. It was an unnamed variety and never again in my life had tasted such delicious mangoes. This was a project initiated by Nizam of Hyderabad that was abandoned. The concept of hidden talents of slum dwellers was projected by the author Vikas Swarup which was the theme for the famous Oscar Award winning movie "Slum dog millionaire".

Like a diamond can be cut from ordinary carbon, potential to perform is there all over. What defines is to identify, package and transform.

The "3 M's" product of stickers that stick but do not stick well is an applied knowledge on a spark of an innovative IDEA. We need to open our minds to see such a potential to build and name it to Global Standards. Start-Up is a phenomenon arising of the concept. Some of the world's best performers today are not through conventional educational system. But their stories provide abundance of scope, to tap such talent and knowledge. Sourcing from scrap is where the seed grows.

Challenges:

Challenges involved in addressing this social issue are:

1. Focus on identification and training
2. Reforms in educational system to accommodate deprived members of Society
3. Tailor made rather than custom built but based on research and development
4. A Global Approach without colour, creed, language or economical status but for those with potential to grow
5. To sustain the approach build infrastructure and processes with trained psychologists and systems
6. Governing from an angle of achievable targets

Study on Suicide and its lessor incidence in certain communities: I have a hunch that there is lesser suicide among Catholic Community in Kerala. After verifying this, if found trues, can we learn anything from their upbringing that other communities can adapt?: **Anonymous**

Civic Sense: Investigate effective ways of instilling civic sense at school level may be researched into: Anonymous Citizen.

SABARINATH, MIT (Alumni of University of Kerala)

I would like to propose a social research on why we as Indians have trouble being a model citizen in our own land but would be a perfect citizen in any other land. Is this due to lack of instilling values in early childhood, what can be done? At least identify the problem. I am talking about seemingly simple issues like, standing in line, being courteous to the person next to you. Simply smiling at a stranger when you make eye contact. I am not talking about rules or punishments, in other countries rules and punishments are needed only for a very small minority, majority of its citizens grow up to be descent humans, both within their families and as citizens at large. Sabarinath, MIT

DR. SABU PADMADAS, Southampton University (Alumni of University of Kerala)

Research for sustainable societies: The following notes highlight some of the critical research challenges that our societies face. This list is by no means exhaustive but offers

some ideas for undertaking research for promoting sustainable societies and human wellbeing, potentially applicable in Kerala and elsewhere.

1. Gender equality and equity in social and economic development
2. Fostering innovation for affordable technology and resilient infrastructure
3. Potential for a diversified economy for sustainable growth
4. Population and social impact of regional and sub-regional flows of migration and concentration of economic migrants in cities
5. Delivering affordable preventive and curative health care to marginalised and vulnerable populations
6. Improving the quality of higher education and human capital
7. Behavioural and psychological disorders and risk factors at family, work and community
8. Innovative technology for tackling crime and civil unrest
9. Public security and safety against terrorism and communal violence
10. Low-cost and clean energy for sustainable environment
11. Public health solutions for tackling emerging and re-emerging infections and antimicrobial resistance
12. Political accountability for safer and sustainable societies
13. Early interventions for long-term and sustainable health
14. Social reintegration and economic wellbeing of return migrants
15. Social integration of short- and long-term skilled and unskilled migrants
16. Catastrophic health expenditure and economic impact of non-communicable diseases
17. Eco-friendly housing and sustainable development in high dense areas
18. Multiple adaption strategies to mitigate climate change risks and changes in physical environment
19. Measuring happiness and wellbeing across individual life course
20. Quality of life and economic wellbeing in post-retirement life
21. Effective use of social media for emergency and non-emergency health care
22. Urban planning for reducing traffic congestion and air pollution
23. Rain water conservation and access to safe drinking water
24. Family cohesion and intergenerational transmission of social values
25. Monitoring social change and human development using innovative research tools

എസ്. രമാഉണ്ണിത്താൻ, സീനിയർസിറ്റിസൺ ഫ്രെ ്വെൽഫെയർ അസോസിയേഷൻ ജില്ലാകൺവീണർ, സംസ്ഥാനകമ്മിറ്റിയംഗം.

ഇന്ന് നമ്മുടെ സമൂഹത്തിൽ പ്രശ്നങ്ങൾ ഏറെയുെ ങ്കിലും വലിയൊരുപ്രശ്നം വയോജനങ്ങളുടെ സംരക്ഷണമാണ്. അവരുടെ സംരക്ഷണം, ആരോഗ്യം, പാർപ്പിടം ഈവക കാര്യങ്ങളെക്കുറിച്ച് ഗഹനമായ ഗവേഷണം നടത്തേെ കാലം അധിക്രമിച്ചിരിക്കുന്നു. ഒയ്റ്റക്കുതാമസിക്കുന്ന സ്ത്രീയ്ക്കും പുരുഷനും യാതൊരുവിധ സംരക്ഷണവും ലഭിക്കുന്നില്ല എന്നതാണ്സത്യം. എന്തുകെ വർ ഒറ്റപ്പെടുന്നു? സാമ്പത്തികശേഷിയുള്ളവരും വിദ്യാസമ്പന്നരുമായ ആൾക്കാരുടെ കഴിവുകളെ സമൂഹം എന്തുകൊ ു പ്രയോജനപ്പെടുത്തുന്നില്ല? ഏതുവിധത്തിൽ ഇവരുടെ ഒറ്റപ്പെടൽ പരിഹരിക്കാം വയോജനങ്ങളെ കർമ്മനിരതരാക്കാൻ സർക്കാർതലത്തിൽ എന്തെങ്കിലും പരിഹാരം കെ ത്തിയാൽ ഒരതിരുവരെ ഒറ്റപ്പെടൽ കുറയുമെന്നുതോന്നുന്നു.

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

Kudumbasree is promoting microenterprises for livelihood of poor women. Wide variety of microenterprises are promoted by Kudumbasree right from canteen and catering, IT, Taxi service, Infant supplementary feed, Apparel Sector, Agri and Animal Husbandry related enterprises many being upgraded to Producer Companies for economic empowerment of Women. But still we have identified some gaps in Marketing, Quality aspects, Technology updation aspects, HR Development aspects, Legal aspects etc. in Enterprises. Profitability and sustainability of the Enterprises is still a gap which affects our enterprises. We think that the Faculty of Legal and Management studies can assist us in certain areas. Also the Department of Home Science, Food and Nutrition can assist in developing the quality and shelf life of the products manufactured by Kudubasree Enterprises. Similarly the University can assist us in developing v arious projects related to women empowerment especially gender studies. Also we have certain programs/projects like Ashraya)Destitute Identification and Rehabilitation Project), BUDS, Tribal and Coastal etc. for social empowerment and assistance of the poor and downtrodden. Students can do project studies in our Organization. Also Research scholars can study specific topics in any of our initiatives. Hence we would like to have a discussion with University of Kerala to workout strategies for Mutual collaboration and Partnership in various Projects including the scope of consultancy services. Kindly make it convenient to have a discussion on all the above possibilities on a mutually convenient date and place.

Carnatic Music Curriculum: The curriculum for Carnatic music education remains static for over many centuries. New technologies have come up and modern theories of instruction have emerged. A new look at this curriculum is required. A research to evolve this will be welcome Dr. A. Sukumaran Nair, former Pro-Vice-Chancellor.

Languages and Linguistics: Scientific revision of type scripts in Malayalam for improving typing and type setting with special focus on retaining conventional pronunciation of the language.

Developing a complete set of revised scientific conventions for citing bibliography and allied reference for reporting Malayalam research studies to confirm with international conventions.

Developing a pronunciation dictionary of English language for Kerala scholars, using Malayalam scripts supported by additional symbols for representing for phonemes not covered by Malayalam language.

Developing a graded series of English text books for teaching English as a second language in Kerala schools with supporting notes in Malayalam for making basic English vocabulary and sentence structures in the English.

Miscallaneous

1. Incidence and prevention of child labour in Kerala in the right the child labour act of 1986.
2. The impact of the latest retrenchment policies adopted by the Gulf countries with special reference to Kerala economy.
3. Socio-political factors which have contributed to the steep increase in the incidence of gender – based criminality towards women in India with a special reference to framing of legislative corrections.
4. Critical re-examination/a retrospective study of the RTE Acts of 2009 for assessing positive and negative impacts of the legislation, to be used in developing a revised legislation.
5. Developing a scientific policy for reemployment and redeployment of Gulf returnees in Kerala following the large scale retrenchment of Indian citizens of gulf countries.
6. A study of the impact of the flow of cheap labour from North Indian states to Kerala.
7. Designing strategies for containing the movements of wild elephants into human habitat in Kerala (by planting deterrent plant spices?)
8. A survey of important garbage treatment technologies for deciding their suitability for use in Kerala's garbage clearance.

General Inputs & Remarks on Research

ROBIN TOMMY, INNOVATION HEAD, TCS INNOVATION CENTRE

Some general remarks aimed at improving Research: The current system of professionals focuses more on the mental capability of mugging up and writing the exam in a detailed manner, with more words and less content. The thinking capacity is turning out to be a scarcity. The problem-solution pattern is never overviewed nor focused in the current curriculum. Focus is more on studies rather than the application of what is being learnt. Research is also just a talk rather than becoming a practice. The system is lacking a process where the students are immersed to the problem scenario and push their thought process to come out with a novel, yet efficient solution from both a theoretical and practical perspective. Mostly in the current process, examinations drive the learning. The student learns for a degree rather than for a living. The education should focus on problems, make the students learn over it and creatively push them for a change. The mindset approach and evolution pattern needs to be studied over time and changes needs to be made available in the education system. As of today, research is nowhere a focus point in the system and which needs a lot of importance for solution oriented and problem solving approach-habit creation.

Proposed Solution

1. Research should be a focus area in the bachelors program.
2. Work on real time problems. Travel around and find problems. Creating a problem statement and evaluating the ROI should be learnt, to make things simpler.
3. PhD graduates should strictly have a discussion with the industry to get the business use cases and bring the literature survey based on the reality of the problem statements.
4. Learning should be based on the problem-think-brainstorm-MVP (Minimum Viable Product)-Final Product-Use.
5. The PhD curriculum should support design thinking, creativity enhancement, innovation and idea inculcation.
6. The students should understand the current environment and try to enhance the boundary of the solution management based on advances in the industry.
7. Follow the industry and research areas and always have a hands-on on the recent advances. The advancements should be instilled quickly and the research scholar's knowledge should be measured on the inculcation and knowledge curve fitting exercise.

8. Relevant research papers should be churned out and patents should be filed with collaboration with the industry.
9. The knowledge acquired during the PhD phase should also be shared with industry and the solution pattern can be a use case for the next PhD aspirant.
10. Whitepapers will help the industry to compare the research topics and what needs to be selected for a particular use case.
11. Industries will always be interested in ROI (Return on Investment). Any solution should have a focus on this area.
13. Thinking exercises, creativity patterns, design stance and idea brainstorming should be the bread and butter of a PhD Scholar.

Conclusion: According to me a PhD scholar should have a problem focus rather than solution focus. Solutioning is something very easy if we understand the problem promptly and solely. Requirement understanding and current solution pattern understanding is also very important. Try the design thinking course for the PhD scholars which would add their ability to look into a problem scenario. Literature survey can focus on white papers along with research papers too. Application of the solution in a scenario can help us in validating the outputs which would be the criteria to award the PhD.

P. HARIKUMAR, TRAVANCORE ANALYTICS, TECHNOPARK, TRIVANDRUM

My opinions can be seen as that of a person not directly connected with academic research. The world owes much to those who have done serious study and research. I write the note below for those studies that have not been done seriously. My Observations on the Current Scenerio:

1. Though statistics is not a good way of evaluating result of research programmes, it is good to subjectively introspect on the research conducted and published so far. As the volume is very huge, please take a 3 month period last year (say April- Jun 2015) and evaluate them based on i) Was that a genuine problem to be solved ?ii) Was there a solution already. If not, Could the person really solve it ?iii) If you really solved it, did you attempt to implement /commercialize /or offer it free as a solution to someone - Is there a taker ? Even a free taker is a testimony of the solution. iv) Most importantly, is there any relevance for this problem to the society - academic, industrial, common people? Pls address this with special relevance to Kerala or India. Those who have completed research can be asked again now - they need not fear of the consequences :)
2. I have seen that VSSC used to give research problems to IIT/Madras. May be to some other institutes too. Some of the problems I know were related to mechanical and

production engineering. Has VSSC given any problems to KU ? Have we returned a value?

3. There are very many research programmes running because it has become a mandate for teacher's career development. Obviously the end result of such research does not matter much to the researcher. This has lowered the bar seriously.
4. Evaluation of the problem is poor. Evaluation of the result is also poor. I am not sure what happens in foreign universities. The situation could be better, but would not be very different. It will be a useful exercise to look at self- funded universities - Indian and outside

Some Suggestions:

1. Set Expectations right: Research programmes, especially PhD, should have strict entry barriers on quality of the problem and its relevance. Should give priority and funding to problems that bring about a constructive change in the life of people.
2. Problem Vs Idea: Research should be aimed to solve a problem, rather than just to implement an idea (idea is not a problem).
3. Time is of Essence: We should be able to distinguish between researches that yield results in bounded time and those that are open ended with contentious results. Personal career aspirations should be separated from meaningful research. Meaningful research should be funded well, others should be personally funded.
4. Incentivize Research: Cash awards or incentives for research outputs that add value to society, when they are put in to real practice. Proportional incentives for industrial research.
5. Involve the Industry. Provide avenues for industry staff to work in University, and University staff to work in Industry. Time based to Result based transition. May be more. You should locate at least one good research that has been practised for making the life really better. Highlight and reward it. Finally it will point to a single solution. Bold Academic Leadership.

SANJAY VIJAYAKUMAR, CEO, STARTUP VILLAGE

Education systems always follow industry. So first came the mechanical wonders and then came the mechanical and electrical engineers training system. It was never that a lot of people were trained in something and they invented it. The invention first happened, at the industry. Thus, in my opinion,

1. A University should do active research on what is happening in industry

2. Fix the timing of how Futuristic research should be (now, 2yr into future, 5-10 years into future and 10 years+ into future)

To do research, we need

1. The people who can deeply study and think and do quality research
2. The research environment (labs, infrastructure, policies, resources etc).

India as a country needs 1million new jobs a month, every month, for next 20 years to employ all its youth. This is possible only if we create many new companies in many new areas. Our new state govt. also has promised 25lakh jobs. This is not an easy task. Thus, from a research being socially useful point of view, Universities need to be in sync with what society needs. I believe that aiming to be a world class entrepreneurship research university would bring KU to a global stage, create global partners from academia, industry, government and support from general society at large. Within entrepreneurship, there are a 1000 research areas from how to create better pedagogical systems in our teaching to how to create advanced technology jobs to how automation and robotics will reduce jobs and what should we do if we face a jobless society.

DR. MURALEE THUMMARUKUDY, UN EXPERT ON DISASTER MANAGEEMENT

I honestly have more suggestions to research supervisors in Kerala than researchers. Not sure if that will help in formulating research problems under them. I will need to make the reply to be generic than specific. So only few principles can be given which are universal and can be tailored to every domain.

1. Make the research students feel proud of their work. It is important that our researchers feel proud of their work, feel themselves striving towards pushing boundaries of science and engineering than just trying to earn a degree or worse get a scholarship. We need motivational orientation programmes for researchers in every university at least once a year.

2. Set strong foundation on research - We need to have a strong foundation on fundamentals of research which include research methodology, ethics, professionalism, language skills, publication and promotion etc. Somebody should design an excellent course in this and introduce in every university in Kerala + invite guest faculty of successful researchers.

3. Promote networking - researchers should be networked between themselves as well as with rest of the world. There should be an annual meeting for all researchers in Kerala only for networking where they discuss not their technical domain but practical aspects of research, career opportunities etc.

4. A newsletter for researchers - there should be a newsletter for all researchers in the state introducing them to new opportunities, promoting their achievements, pdf

opportunities.

5. Promote our researchers - give them generous recognition even when they publish a paper, give awards for papers, give awards for best PhDs and so on. Money is not important. I know many parts of these are already happening but bringing them together and institutionalizing them will be nice. Now in terms of PhD topics.

1. Relevance - select a topic which is relevant globally. I am not one who will say take a local topic. The topic could have relevance locally but that is not the focus. We should set our eyes on the world and then if we bring it down to our state, then best. For example we can do world class climate modeling, but focusing on Kerala.

2. Continuity - faculty members should take a bigger problem and slice into few discrete chunks to be done by multiple students across the year.

3. Interdisciplinarity -faculty should come together, at least from two faculties to define problems which are then followed by students from both faculties. There is abig market.

DR. PRAHLAD VADAKKEPAT, ROBOTICS EXPERT, NATIONAL UNIVERSITY OF SINGAPORE

What I perceive is that, from the point of view of relevance to life, lately, companies are resorting more to understanding the needs of people (known, unknown, latent, explicit). Ethnography and human ecology are becoming very much part of the research and development of products and services alike. From another angle, the current generation can be excited with a purpose in life in a logical manner.

From such an angle, if we can ground the scholars to expose them to societal issues and potentially useful (purposeful) approach to problem solving or solution building, they will get excited to go for a deep dive. The scientific approach to understanding a problem in depth is crucial and which is being pushed around / compromised due to the eagerness to publish. For instance, in a history department, we can explore interesting studies along community development, community movement and several aspects related to human ecology. I am mentoring 3 students (in India) who are trying to understand human trafficking in India. They are from Jharkhand, Jaipur and Kerala. One of them is a law student (LLB) and the other two are from Engineering (Manipal Institute of Technology). It is amazing to learn about various aspects of the issue. I have learned about the "culture of silence" that is prevalent in our society and there are books written on it. What I conveyed to them (three students) is not to think of a solution now. The aim should be to understand the problem in depth and as broad as possible. The discussion is going on for the last 10 months. They are in their 2nd year of study. Last month, I have another person who was in Singapore, who will join IIT Gandhinagar for PhD, helping them. Her PhD

area is within "post-humanism." When I shared about the three students' project, the PhD scholar was able to clearly connect to several topics related to her research. For her, such real life problems are most suitable and relevant.

In the above project, it is possible to have other disciplines involved as well. The final aim of the research is to come up with a solution that will be suitable to tackle the menace of human trafficking. Here, social science, history, community development, engineering and other disciplines converge. Such convergence of disciplines can be exciting.

I feel that the bigger picture is always not understood by scholars and mentors alike. Or, the bigger picture is not given enough importance. Quick solutions might be driving research aimed purely at publications / degrees. Need to come out of that vicious circle and there should be problem specific brainstorming to happen. We use brainstorming rules [https://en.wikipedia.org/ wiki/ Brainstorming] for ideas in the "Innovation & Enterprise" module where New Product Development is elaborated. I feel that such rules can be utilized. We also use mind-mapping software [www.xmind.net] to get a bigger picture from literature review.

I love ethnography approach to understanding problems. We take our students to a remote rural village in Maharastra every December and live there for weeks. It helps the students to ground to the problem and to perceive the contextual constraints well. By doing that we can feel them able to understand them-self better allowing their empathy to manifest.

We need to take the scholars to reality and show them the purpose of their research useful to humanity in certain setting. That will help them to appreciate the problems better and to go for a deep dive. We play the following video in the first lecture of the module "Innovation & Enterprise." https://www.youtube.com/watch?v=2Dtrkrz0yoU. I think that such relevant videos from the web helps scholars to get a bigger picture and to connect several dots better. It also help them to see how others approach problems. Another aspect which is important is to visit other Universities. The Japanese and Koreans are good at that. They take their students across the globe to expose them to other cultures. That helps them to know their own culture better in relation to others.

CYRIAC DAVIES, MANAGING DIRECTOR, KITCO LTD.

Commercialization of Research/Lab Technologies: Universities are rich with numerous advance research and development studies on emerging technologies spread across

various fields of applications. Making all the research and development thesis/publications publically available for the young entrepreneurs/Startups, will enable further development resulting into useful products and services. This can be attempted by compiling all the past research papers and presenting potential research papers through series of seminars/conferences. Students with entrepreneurial zeal will seize this as an opportunity to develop useful commercial product/service.

Adoption of industries especially PSUs by a group of colleges: It has noticed that many of the emerging startups require design tools, manufacturing facilities, testing facilities etc. for developing the prototypes. The existing industries, can act a facilitator for such startups by opening up the existing equipment and systems for the use of startups. Providing access to the industry premise to startups and students will help the industries to get familiarization with modern practices and technology infusion enabling them to develop new products and services needed by the present day market. Create a formal platform for industry to interact with campus based startups towards developing high end products. The same can be initiated by encouraging leading industries to set up their R&D centre at selected campuses. Presence of such centres will bring new synergy to the students and lead research based on industry needs. Establishing a strong industry linkage as mentioned above will provide requisite development and testing facilities at affordable cost to student startups.

Research in Emerging and Future Technologies: Encourage research on advance and emerging technologies in sectors like electronics, material science etc. Such researches can be initially undertaken through set of students with each individual college taking a particular sector as focus areas from lighting devices, smart electronics devices, defence technologies, health care devices etc.

Training on Business skills and Business functions: The industrial and entrepreneurial environment is continuously evolving and the market force are no more local. Student startups working on research based products/lab technologies will require guidance and training on developing viable business plans. Also, such startups will require training to build business orientation and for acquiring business skills. Industry experts, successful entrepreneurs and agencies like KITCO can contribute immensely in this endeavor as an enabler. Presence of such a guided environment will enhance the success rate of student/campus startups considerably.

We take this opportunity to extend all support in University's endeavor to create a new learning culture integrated with useful outcome.

CLIF KUSSMAUL, FORMER FULBRIGHT VISITING PROFESSOR IN UNIVERSITY OF KERALA (FROM USA)

As often happens, a seemingly simple request leads to deeper reflection and insight. Researchers don't need better ideas, they need better processes & collaborations. Venture capitalists prefer an 1st level team with a 2nd level idea over a 2nd level team with a 1st level idea – a great team will succeed, but a lesser team won't. So my advice to researchers (faculty & students) is as follows: Choose projects that excite and motivate you. This seems obvious, but doesn't always happen. Research values novelty, but just because an idea is new doesn't mean that it is useful or exciting. I see this in conferences – there are always a flood of papers using the latest buzzwords, just because they're new. Instead of creating a novel solution and then looking for a problem, choose a real problem and find a good solution. Choose projects that excite good collaborators, since collaborating is much easier than working alone, especially if you like and respect each other. Collaborators bring different skills and perspectives, so you will find and solve problems in better ways. Collaborators provide encouragement and support – when one person is busy or stuck, another can help move forward. My best (and happiest) collaborations have been in such settings, where we had a group of great people with diverse backgrounds who liked working (and playing) together. I've also been in settings where individuals were just as capable, but without the sense of collaboration and community. A top university can have experts in everything. Other places need to choose and focus on a few areas of specialty – this is sometimes called a T model, where there is broad (but shallow) experience in many areas (the horizontal part of the T), and narrow but deep expertise in a few (the vertical part of the T).

Choose projects that matter to other people. Good projects also benefit from external stakeholders – advisors, clients, customers, governments, investors, publishers, target markets, etc. They provide important advice, feedback, emotional support, resources, etc. Focus on projects that will directly help your institution, local companies, governments, and not-for-profits, and your broader community.

I made several key mistakes with my PhD thesis – I came up with something novel, but not very useful, and not something I was particularly excited about. I didn't have collaborators – my committee was helpful, but my topic was outside of their expertise. However, my POGIL work has gone very well – I am excited about improving education, the POGIL community in general and my CS collaborators in particular are wonderful, knowledgeable, and fun to work with. Our work is making a difference – we've gotten a sequence of grants and publications, have helped many faculty rethink their classes (which helps all of their future students), and our work is changing education in CS and

other disciplines. I now have a motto – always have at least 3 reasons to start a project, so it is still useful even if 1 o r2 reasons don't work out. Thus, I suggest that universities in Kerala create more (interdisciplinary) research centers. Make the selection process competitive and as open and transparent as possible, to encourage and reward researchers who talk to each other and want to take on new challenges. Some of the centers might include several academic organizations, and some might include non-academics – e.g. Technopark, VSSC. Centers might get priority for new or renovated space, special facilities, and new faculty positions. My personal preference would be a Center for Teaching and Learning to emphasize and expand the use of evidence-based learning practices and the "scholarship of teaching and learning". Less lecture and rote memorization of facts, more active learning with guided inquiry learning, problem-based learning, project-based learning, etc. to help students develop critical thinking, problem solving, communication, and other essential skills. These ways of learning and thinking will help students in their in their careers, will helps their companies and improves the reputation of their universities, which helps them recruit more and better students, who can do more and better work, which helps them recruit more and better faculty – a virtuous cycle. Here are two institutions I'm familiar with that do this: - Olin College (USA), -Ashesi University (Ghana). Do universities in Kerala have coop programs, where students work for local companies? This seems like another good way to help students develop relevant skills, build ties with local businesses and other organizations, etc.

PROF. GOPALAKRISHNAN, CHAIRMAN (FACULTY), AMRITA CIVIL SERVICE ACADEMY

I have always felt that it is what has been done that directs what is to be done. Research is no exception. After all, research is to re-search. Research in universities is done, often, as an academic compulsion. Increments, promotion, the never-dwindling fascination for the prefix are some of the reasons for this kind of pursuit. So, if research were not made obligatory for promotion, it would be taken up, I think, only by scholars for furtherance of academic interests, not for material benefits. This in itself could improve quality. There are, at least in the humanities, four reasons for taking up a particular topic for research: guide's interest in the domain, availability of search material, time available for completion and ease of operation. Central questions like how do I make an original contribution, how can I make my thesis unique, how best can I pursue it to make it socially relevant and how can I bring in utmost rigour in my work … are questions that are seldom posed, let alone answered.

Critiqued from this perspective, research should gesture itself thus:

a. The ultimate beneficiary of all research should be either the student or the community
b. It should be made mandatory for the teacher who proceeds on paid leave to submit how his salaried absence would be amply compensated for.
c. Periodic progress assessment is imperative for timely completion
d. Open Defence should not be a platform for civilities and refreshment alone but an opportunity for enlightening interaction as well.

At a time when information is in abundance, scarcity of relevance should not occur. There has to be regular interaction among college and university teachers wherein the former can table teaching issues and the latter, research prospects. This academic symbiosis (Shall we call it 'inclusive inquiry'?) can make research more meaningful.

PROF. K. SUDHAKAR, PROF, IIT, BOMBAY

Primary stakeholders in a PhD programme are those who hold a direct interest in research outcome of PhD research. Stakeholders must also include those who are interested in human resource coming out of PhD programme to execute cutting edge research (ie. Interested in research scholar him/herself).

I would say there are 3 things to consider in putting in place a good PhD programme;

1. How to pick a research problem from out there
2. How to solve the problem
3. How to reach solution to out there.

Step -2 here is as important as the first and the third. Irrespective of the goodness of the research problem a research scholar must learn the process of taming it through a structured approach to create new world-class knowledge and show case that new knowledge; and do all that with high level integrity and ethical behavior. This approach to problem solving is what will shape him/her as a valued human resource to contribute to the world after (s) he steps out of the University.

An outcome orientation to PhD programme (where we define what we wish to see in a research scholar who becomes eligible to receive his/her PhD degree) can be useful. As indicated at item (A) one has to focus on many other aspects of grooming a scholar no matter what is the research problem. A baseline thought in this direction can be a bullet list of attributes (http://www.nsf.gov/).

i. World-class knowledge in a relevant specialty
ii. Ability to develop work-class knowledge in related areas

iii. Understanding of how specialized knowledge aligns with the larger context of knowing and understanding
iv. The ability to understand and be understood by those in other disciplines and other cultures
v. Awareness of all effects of globalization and technology-and the price they exact on society
vi. Leadership, as reflected in breadth of knowledge and ability to articulate ideas, confidence, poise and focus
vii. Ability to define and solve problems
viii. Ability to deal with predicaments as well as problems
ix. Ability to both a thinker and a strategist.

DR. SABU PADMADAS, SOUTHAMPTON UNIVERSITY (ALUMNI)

Advancing Interdisciplinary Research for Sustainable Societies

The following notes provide some pointers and suggestions towards improving the uptake and quality of interdisciplinary research. University of Kerala has immense potential and scope to nurture and sustain research leadership, for which inclusive planning, investment and implementation strategies are needed.

Improving the Uptake and Quality of Research

1. A research oriented postgraduate programme is definitely a good start where students can be offered credit-based research skills (design, analysis, writing and communication) training with a practical orientation. These are presumably already existing but can be strengthened to enable students to think 'out of the box' (beyond discipline boundaries) reflecting on current social, economic and technological challenges. The training should reflect on harnessing professional and transferable skills and should be offered to all those entering postgraduate doctoral programmes at the university level.

2. The University could consider establishing a central hub for promoting high quality research skills training and offer short training specialised and generic courses (e.g. 1 week) addressing the research requirements of different disciplines.

3. Our students, especially doctoral and post-doctoral researchers, need to develop confidence and independent skills to design, implement and manage research. They need to be exposed to both national and international research opportunities and engaged to existing research projects providing opportunities for them to interact with experienced researchers.

4. The organisation of doctoral research programmes could be improved by (a) conducting annual internal formal review of thesis progress and an intermediate examination for transfer from MPhil level to PhD; (b) introducing compulsory

seminar presentation at least one each year during the course of programme; (c) engaging researchers (10-15% of their time) for teaching Masters level students; (d) encouraging and providing support for PhD researchers to attend national and international conferences and (e) more importantly, coordinating the examination process ensuring that the research outputs are either published or of publishable quality in peer-reviewed national/ international journals.

5. A central research information systems can be established to inform, encourage and assist academic staff and researchers to write competing peer-reviewed research proposals for state, national and international funding. This system can also function as a nodal point to promote international research collaboration.
6. We can set milestones, internationally competent thresholds, evaluate the quality of research outputs, conduct annual research formal appraisal and provide incentives (research awards, promotion, financial rewards) for academic staff.
7. Identify departments, centres, institutes which are already performing well at national and international standards, provide basic infrastructure and human resources. In addition, identify those units which demonstrate evidence of potential for research growth.
8. The University could consider coordinating distinguished lecture series on emerging and re-emerging critical issues (e.g. related to sustainable development, population dynamics, societies, technology, environmental and climate change). A calendar of events (for a year) could be circulated ahead of the lectures. The lecture could take place on the last Friday of every month at the main campus.

DR. KUNCHERIA ISSAC, VC, Kerala Technical University

We should try to select problems the community is likely to face 5 years/10years from now so that by the time you complete the work, it will have high application. The engineers shall look into the grand challenges prepared by NAE, USA and the Technology vision 2035 of TIFAC to find out the problems for research rather than searching the literature alone for finding the problem. Of course state of the art by searching the literature is essential. The problem we face is that we try to marginally improve a system or process which has very little application by the time you come out with the outcome of your research.

DR. BABOO M. NAIR, PROFESSOR EMERITUS, APPLIED NUTRITION, FOOD HEALTH SCIENCE CENTRE, LUND UNIVERSITY, SWEDEN

During my visits to University of Kerala, I had opportunities to have discussions with many students and teachers of the university. What comes to my mind is that the

students themselves did not understand (not conscious or not troubled over) the fact that the University of Kerala is trying hard to improve the quality of its output by way of research and education. I felt that the students were clever and were satisfied in doing the minimum. In general it is my observation that they did not express much ambition to do a great job. Some dreams in that direction were there and perceivable but not that they will die for reaching that goal. I felt the same attitude among the teachers too. Somehow achieve the minimum to publish a paper, finish the thesis and get out with a degree etc. were clearer than the thirst/urge/desire for knowledge and strong devotion to research as the mission. The university campus did not appear to be a place where tomorrows intellectuals were in discussion about big questions of tomorrow except for the presence of red flags all over in large numbers. I felt that the flags has been placed there in large numbers to mask the lack of interest in real matters like quality of the performance of the university in advanced research and higher education.

I am sure that you know very well that the quality as well as quantity of the performance of an institution depend upon many factors and many people. It is the manifestation of the total performance of every category of employees, teachers, administrators, students, leadership and supporting staff at every level. What I find it as a weakness at Kerala University and almost all institutions of India I came into contact with is the bad behaviour of out sourcing. Everyone will keep asking somebody else to do the work they could do, they are supposed to do or expected to do.

I can illustrate this by relating a story which I hope you will enjoy. Let us say that you are visiting a director of an establishment. While speaking to you the director may ask" Do you like to have a cup of coffee Dr. Nair?" And you answer "yes please a cup tea thank you". Then the director will invariably call his assistant to ask him to bring a cup of tea for the guest. Then the assistant will go in turn to his own assistant and ask him to bring a cup of tea to the office of the director. The assistant of the assistant will then ask the clerk of the office and the clerk will ask the peon and the peon will at last ask the teashop near the office to send a cup of tea to the office. It will naturally take some time and an innocent soul in the form of a poor boy come to the office with a cup of tea and the boy with the tea will stand there wondering what to do with the tea as everyone in the ordering chain especially the peon who wanted the boy to bring the tea has become least interested and therefore invisible as far as anyone can see. Then it is left to the imagination of the poor boy to find a solution as it is his remuneration which is at stake. In this scenario, the boy is the helpless one as it is he who has to deliver the tea and bring back the money to the tea shop if he is not to be beaten up by the owner. Soon many people will become engaged and start running here and there for some time, asking who

ordered a cup of tea, until at last the tea reaches the director's office. The director asked you for a cup of tea as a matter of routine/courtesy. He may not even care very much if his mission is achieved or not. The turbulence of the situation often will absorb all the mistakes and miss happenings as well as deliver reasons for excuses and just turbulence is everywhere as a blessing to every one ! Now the tea can be substituted with anything else too with full compliance. Making/asking other people do things is a normal/common thing in India in every sector and in every state. This behaviour undermines the quality of the result in every walk of life. Even very simple assignments are out sourced not only in offices but also in homes. Somehow most people feel that they are great if somebody else keep doing their job. Of course, I am the first to agree that there are exceptions to this and to some extend there is also need to request others for help in executing your duties. But to ask somebody else to do the work which is destined to you is very common to India. It is so common that it works negatively when it comes to keeping the standard of quality. Because you outsource the work but not the quality criteria.

Now, I would say that it is the duty of the university itself to produce the critical mass of ideas for its own input in advanced research and higher education. It is the activation and motivation of the employees which is necessary/required. If a university is poor in ideas, it is very bad. No industry or outsider can contribute to compensate the lack of ideas. Because, you need some receptor/receptivity to absorb ideas relevant to the purpose even from an industry. Once you have an active research going on in your department, it will be easy for you to take in an industry project. At the same time an industry project cannot be taken in if there is no own research in the field is going on at the department.

It is the nature and characteristics of the inner activity of the university which has to be improved for improving the quality of its performance out wards. I think, it is the leadership which has to express its vision mission and strategy in the activity/management of the university with utmost clarity. Improvement of quality cannot be outsourced. It has to be carried out by the university itself. It should be recognized and acknowledged that it is the duty of each and every employee to be fully involved in improving the quality of the day to day performance as well as its long term performance.

My suggestion is that the leadership has to take it as a mission to define the quality and quantity of the performance of the university as clearly as possible to its employees students media and the society. This should be done with the cooperation and active participation of all the personal categories. Quality assurance is a continuous day to day process at every point of delivery. The duty of the leadership (vice chancellor and the

deans) is to make the employees aware of this fact and make them integrate it as a part of their duty/job and this this will not function well if the leadership is not subscribing to its own principles.

How to do that: If I were to be the vice chancellor, I would start a process/series of meetings. The first meeting with the deans of all faculties. The second meeting with all the head of the departments. The third meeting to address all the employees and post graduate students of all the departments. The fourth meeting to talk to the representatives of all the trade unions connected to the university. The fifth and final meeting in this series will be a meeting of the pro-vice chancellor, vice chancellor pro-chancellor and chancellor to inform each other and to collect advice and political and financial support for forming a strategic plan for the improvement of the quality of research and education of the university and its implementation.

The next is to develop the actual strategic plan for the university for five years and suggestions on how it will be implemented. Each department should be invited to contribute a plan for their department. Each faculty/dean should be invited to contribute its plan and also a plan from each trade union representative. The final strategic plan should be a synthesis of all the contributions and it should be placed in front of the syndicate and senate for their information and approval.

The next step is to discuss and create a continuous digitalised monitoring system/ procedure to see to what extend each department follows its own rules of the game and the rules of the game set forth by the university. In monitoring as well as in everything mentioned above digital administration procedure may be applied. Digitalization of performance in relation to goals on one hand and rewards and /or punishments on the other hand may be effective.

The university could/should think of developing a performance portal. Anyone could be allowed to take advantage of the information presented in that portal with utmost possible transparency. Courses, course handouts, laboratory notes, instructions, study questions, report of the seminars, results of the workshops etc. can be made available to the public and also to the interested industries.

The university may also consider a few things. (Which are applied in our university)

1, Allow maximum possible freedom of activity to the researcher in planning and execution of their own research and education.

2, Allow maximum possible freedom of activity to the researcher to own the IPR of his/her research activity with him/her as his/her property.

3, Allow maximum possible freedom of activity to the researcher to take initiative in bringing ideas to the university for consideration and implementation

4, Allow maximum possible freedom of activity to the researcher to have collaborative projects with industries and nongovernmental agencies.

Then it is also up to the leadership of the university to see that the researchers are motivated, inspired and put/expose them into such circumstances which will promote exercising above freedom in practice

Every product we export should have the highest amount of new knowledge in them. We must not concentrate on exporting things/material. We must on the other hand concentrate on exporting new knowledge to gain revenue. Even if we do not succeed in obtaining any break through at once, it will in a long run, raise the standard of the quality of research and education in Kerala. Failure by working with difficult problems will improve your knowledge level more than success by working with simpler problems. What we must teach the researchers is to define the problem well in such away that anyone can understand it and try to solve it even if/when you have become unsuccessful.

Every researcher should follow the principles of research and carry out the work following the rules of the game when it comes to formation of a hypothesis, design of experiments, collection of observations, making tables, drawing figures, doing statistical analysis of the results, and making conclusion based on the observations. To avoid generalisations and drastic conclusions based on a few observations are important measures in keeping the quality of the research intact. These can be taught in a class room or learned by reading a suitable course book.

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

Kudumbasree is promoting microenterprises for livelihood of poor women. Wide variety of microenterprises are promoted by Kudumbasree right from canteen and catering, IT, Taxi service, Infant supplementary feed, Apparel Sector, Agri and Animal Husbandry related enterprises many being upgraded to Producer Companies for economic empowerment of Women. But still we have identified some gaps in Marketing, Quality

aspects, Technology updation aspects, HR Development aspects, Legal aspects etc. in Enterprises. Profitability and sustainability of the Enterprises is still a gap which affects our enterprises. We think that the Faculty of Legal and Management studies can assist us in certain areas. Also the Department of Home Science, Food and Nutrition can assist in developing the quality and shelf life of the products manufactured by Kudubasree Enterprises. Similarly the University can assist us in developing v arious projects related to women empowerment especially gender studies. Also we have certain programs/projects like Ashraya)Destitute Identification and Rehabilitation Project), BUDS, Tribal and Coastal etc. for social empowerment and assistance of the poor and downtrodden. Students can do project studies in our Organization. Also Research scholars can study specific topics in any of our initiatives. Hence we would like to have a discussion with University of Kerala to workout strategies for Mutual collaboration and Partnership in various Projects including the scope of consultancy services. Kindly make it convenient to have a discussion on all the above possibilities on a mutually convenient date and place.

SADASIVAN KP, CONSULTANT (LIBRARY), IIITMK, TECHNOPARK, TRIVANDRUM

01.Research: Shallow vs Deep: There is a general opinion among the peers, especially those from abroad, that the scope and treatment of the research topics are by and large more shallow in nature than deep into a specific problem.

02. Topics with Societal Relevance: UK HEC Model: The trend among the leading Universities the world over is towards choosing research topics with Societal Relevance. The UK Higher Education Council has even gone to the extend of rejecting proposals for doing PhD, if the topic chosen happens to have no societal relevance.

In our country/ State, there is no dearth of socially relevant topics necessitating a solution by applying the appropriate Science/ Technology base. It needs to be analyzed based on the, say, last 5-10 years of chosen research topics in Kerala University before finalizing the strategy for future.

03. Industry-Academic Interaction:

(a) For identifying and resolving issues aimed at mutual benefit, it needs to be examined critically. The existing misconceptions/ mistrusts need to be de-mystified. The University can even create a framework of the possibilities existing in the industrial sector of the region (and elsewhere too) vis-à-vis the research strengths of different disciplines/ departments of the University so that the prospective research scholars can be given a sort of Guidelines on the choice of their topics.

(b) Many of the academically excellent pieces of PhD works carried out earlier end up in closed shelves eternally. The potential application of such works are seldom understood and applied in real life situations. For instance, a Computational Modeling and Simulation work of a Chemical Engineering Process would have been carried out from the Computer Science Software/Programming Perspective. With appropriate refinement, it can perhaps be used in a real life factory environment to optimize a dynamic Chemical Engineering Process, cost effectively. There can be several such examples transgressing different disciplines. Biochemistry/Biotechnology applications for Health Sciences problems of specific regional or national significance is another such case. Fusion of Computer Science/Information Technology and Agriculture is yet another example.

(c) A cohesive approach with the thrust areas given in the Policy Planning Documents of the national and regional organizations like ICAR, ICMR, DBT, Department of Health Sciences Kerala, Department of Agriculture Kerala, Centre for Development Studies, Sector-wise Perspective Plan Documents of State Planning Board, etc. are necessary ingredients/ inputs for the quality improvement exercise in our University Education System.

(d) A Major Scheme of Internship Programmes in the industrial sector for the Post Graduate Students of the University has to be worked out as a sustainable prelude to research-oriented higher education.

04. Effective interaction with R&D establishments: Equally important as at Para 03 above, is the creation/ strengthening of an effective interactive mechanism with the R&D establishments of the State. It will catalyze the process of discovering new ideas, strengthening expertise and sharing knowledge, instrumentation and other infrastructure facilities. Improvement in the rate and quality of Publications and Patents are also possible.

05. Peers+ PDF Scholars Cushioning Package: An intellectually elite ambience is an integral part of quality research– from the stage of its conceptualization to its ultimate delivery. Intermediary stages are equally important, particularly with a shareable ecosystem to build confidence and meaningful mid-course corrections.

Lectures, Workshops, Seminars – both internal and external – with the participation of Peers is certainly an added advantage and are in practice too, in many departments. But beyond that, one proposes a different/novel mechanism for consideration for implementation. Large number of young Post-Doctoral Fellows in different disciplines and basically hailing from Kerala are scattered in different leading institutions across the

world. Creating a 'Virtual Pool' of such Scholars selectively and engaging them for short/ very short term programmes in the departments concerned will certainly be a value addition to the works of the young PhD Scholars. This may be tried on an experimental basis.

06. Good Bye to Conventional Research: Our conventional research practices including (i) Selection of Topic (ii) Literature Survey & Review (iii) Research Methodology followed (iv) Experiments carried out (v) Data Analysis (vi) ICT Applications (vii) Results, Inferences and their Impact Study (viii) Publishing Patterns and the Criteria thereof ….All these need total re-structuring in the context of the fast changing eco system of Higher Education in the global scenario.

07. Careerism vs Professionalism: The predominant factor prevailing at present among the young researchers is to get a doctoral degree as the 'Passport' for fetching a job. The concept of careerism has engulfed the merit of 'Professionalism'. Well, our prevailing socio-economic conditions may be a contributory factor for this state of affairs. Naturally, erosion of quality of research will be the consequential damage to our education system. So the Government and the University System have to carefully think, plan and decide as to how the quality assurance is not diluted in the higher education domain.

08. Academic Administrative Managers vs Political Managers: The Vice Chancellor and the other top officials of the University should be well reputed academicians with knowledge, wisdom, vision, diplomacy and administrative capabilities. Political interference in choosing mediocre personnel will only spoil the quality and standard of the University and its products. De-politicization of the academic sector is essential for ensuring quality education.

09. Role of Professional Societies in Promoting Research Culture: Professional Societies have a significant role to play in creating the right ambience for imparting quality education and ensuring its sustenance. The well planned programmes of professional societies can make the academic environment more vibrant and focused. Moreover, the Research Students, as its bona fide members, will develop a sense of identity as members of an academically elite group, which, in turn will imbibe the spirit of doing quality research.

Well, many of the professional societies should wake up from their deep slumber and rejuvenate their own activities for accomplishing this target. The University, in turn, may examine whether membership in such well reputed Societies could be made mandatory.

10. Promoting Interdisciplinary Research Programmes: Most of the departments in the University do confine PhD research programmes within the 'boundaries' of their own respective disciplines. But it is being widely accepted that inter-disciplinary research programmes are fast emerging as a more innovative and productive mode of research. There is need for initiating some thoughts on these lines.

11. Promoting Publishing & Patenting: A universally accepted Metrication System to Measure the Quality of Scholarly Publications needs to be introduced in the Kerala University System, in tune with the stipulations of mandatory agencies like UGC, AICTE, etc. Suitable benchmarking shall be prescribed for compliance by the Research Scholars too, before their final Open Defence.

(a) The status of filing of Patents uptill now by Kerala University is lamentably poor. Some of the recommendations proposed in this document, especially vide Para 03, 04, 10 & 17, if implemented, are sure to put the University in the Map of Universities regularly filing Patents.

The impact of this change is expected to reflect in the PhD Scholars' works too.

12. Augmenting & Modernizing Infrastructure Facilities: Be it the Library System or the Instrumentation facility, the University needs both augmentation of the existing facilities and modernization with new Resources, Facilities and Services. These changes together with the recommendations made vide Para 03, 04, 14, 16, 17 & 19 are expected to achieve quality improvement in academic research.

13. Introducing New Avenues of Learning Processes: The ICT-enabled Learning System Facilities are the hall marks of Higher Education globally. But they are yet to make an entry/impact in the domain of education in Kerala University. If implemented with careful planning and judicious spending, the resources and services will be unlimited. The young Research Scholars are sure to quickly migrate to the new paradigm and the results will certainly have a cascading effect in terms of quality and efficiency.

14. Creating/ Strengthening Research-Planning & Development Cell of the University: If such a system already exists in the University, it will, in all probability, be functioning as an Administrative mechanism.

What is now proposed is a kind of Academic-cum-Research Apex Body with the responsibility of :

i. Planning, Developing, Implementing and Monitoring the Programmes of various Depts.
ii. Performance Appraisal based on Output/ Outcome/Accomplishments of Assigned Tasks
iii. Performance Auditing

iv. Identification and implementation of Collaborative Programmes with regional, national and overseas agencies and institutions including Exchange Programmes for PhD Scholars to strengthen their research work

v. Fixing of Long Term & Short Term Development Plans & Targets ensuring better visibility, acceptance and ranking of Kerala University.

15. Promoting Inter-Institutional Research Programmes with Regional, National and International Institutions: This is partly covered in Para 15 above. But that apart, major collaborative research programmes with other leading institutions will have scope to accommodate PhD Scholars to carry out part of such Projects as the topic/area of their academic research work.

Support from the Alumni of Kerala University holding key positions in major institutions – Private or Public - all over the world can also be explored and made use of.

16. Promoting to Undertake Externally Funded R&D Projects: University should encourage and promote undertaking of major R&D Projects funded by various Ministries, Organizations and Departments of Government of India. At present, only isolated cases apparently exist. This needs to be introduced more extensively among all possible departments having some stake/ expertise in the area concerned. Several Universities in other States are much ahead of us in utilizing such possibilities.

Apart from improving the financial condition of Kerala University, it will have direct impact in quality improvement of its academic research programmes too, as partly indicated in Para 15 & 16 above.

17. Consciously Attempting to Shift from the 'Era of Awareness Programmes' to the 'Era of Research Programmes per se': A closer examination of scores of PhD Theses transgressing different departments reveal that they are all mediocre works and do not contain an element of innovation ; they do not propose new ideas or new processes or techniques or devices to enhance the existing knowledgebase; they do not even help trigger the thought process in a different direction. These so called 'Scholarly Works' can perhaps be equated with 'Awareness Programmes' rather than serious 'Research Programmes per se'. This needs to be addressed. Stricter academic –cum- aptitude screening of the aspiring researchers at the time of registration and rationalized criteria for the selection of the topic for research, can partly help filter out incompetency.

18. Knowledge Resource Consortia Initiative: The abundance of literature and information resources available and accessible in the public domain either priced or free of cost is a blessing for the academic and research community of modern age. The variety

of modes, techniques and devices for getting such resources (mostly, e-Resources) at variant forms add tremendous value to the speedy success of the research programmes undertaken by the scholars. Consortia approach plays a major cost-effective method in facilitating use of such resources. Kerala University can perhaps take the lead in initiating such resource mobilization schemes in association with other Universities in the State to ultimately benefit the scholars.

19. Creating a 'Think Tank' for Quality Assurance in Higher Education in Kerala/ Kerala University: Creating a 'Think Tank' at the State Planning Board OR Higher Education Council level OR even at the University level as described in Para 15 above, preferably with the inclusion of external experts too, on **Quality Assurance in Higher Education in Kerala**, with constant metrication, monitoring and forecasting mechanism is an option worth considering.

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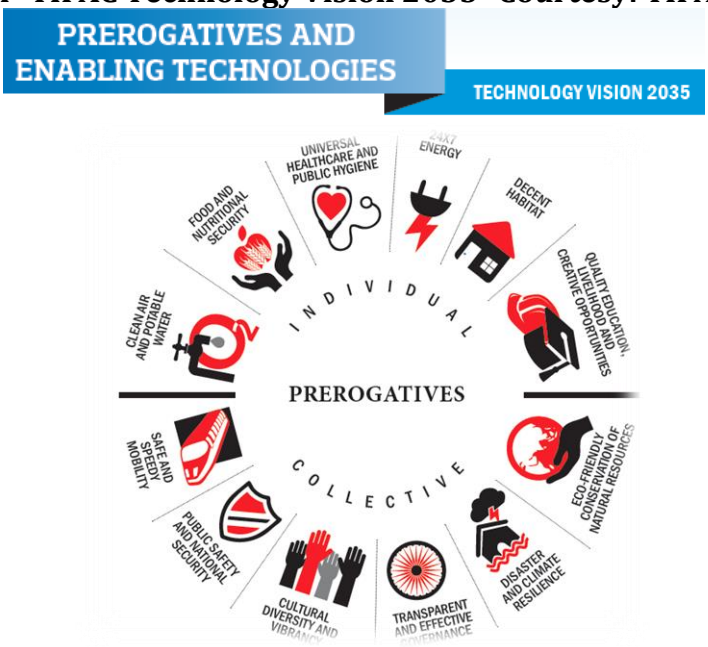
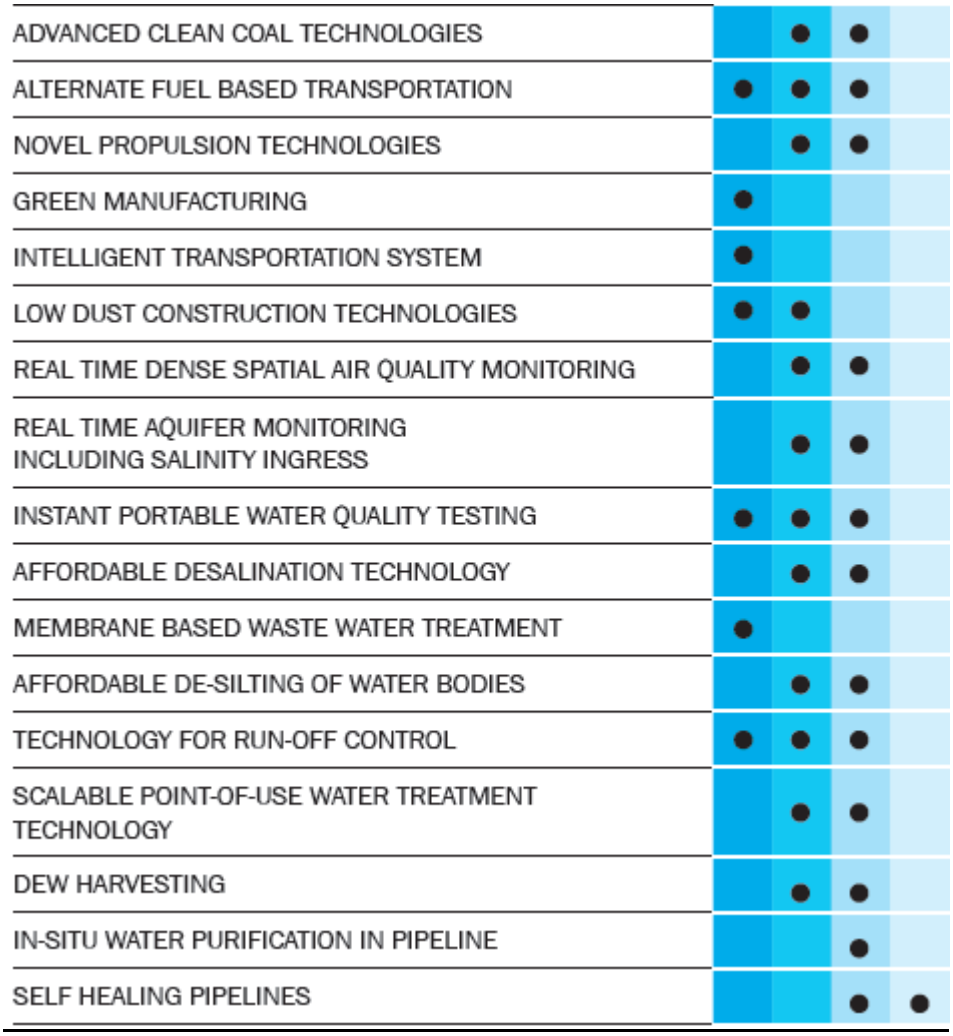
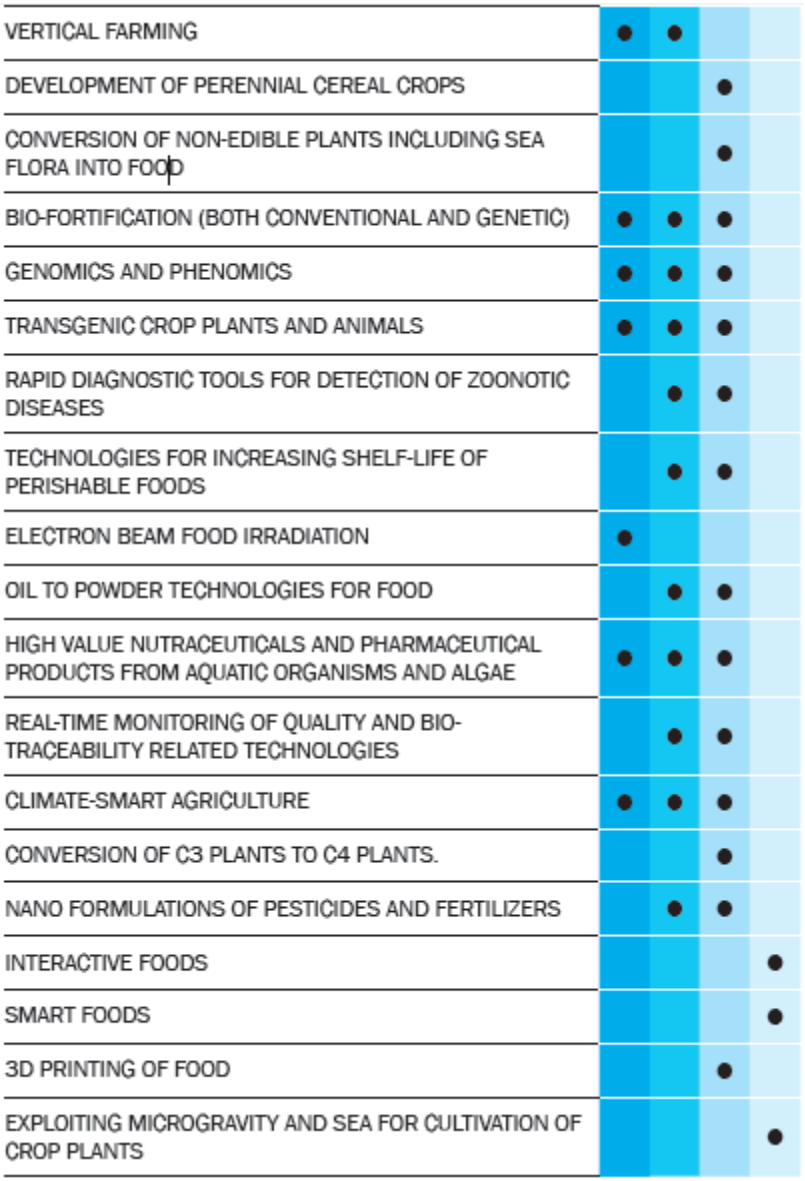
Extracts from "TIFAC Technology Vision 2035" Courtesy: TIFAC, New Delhi



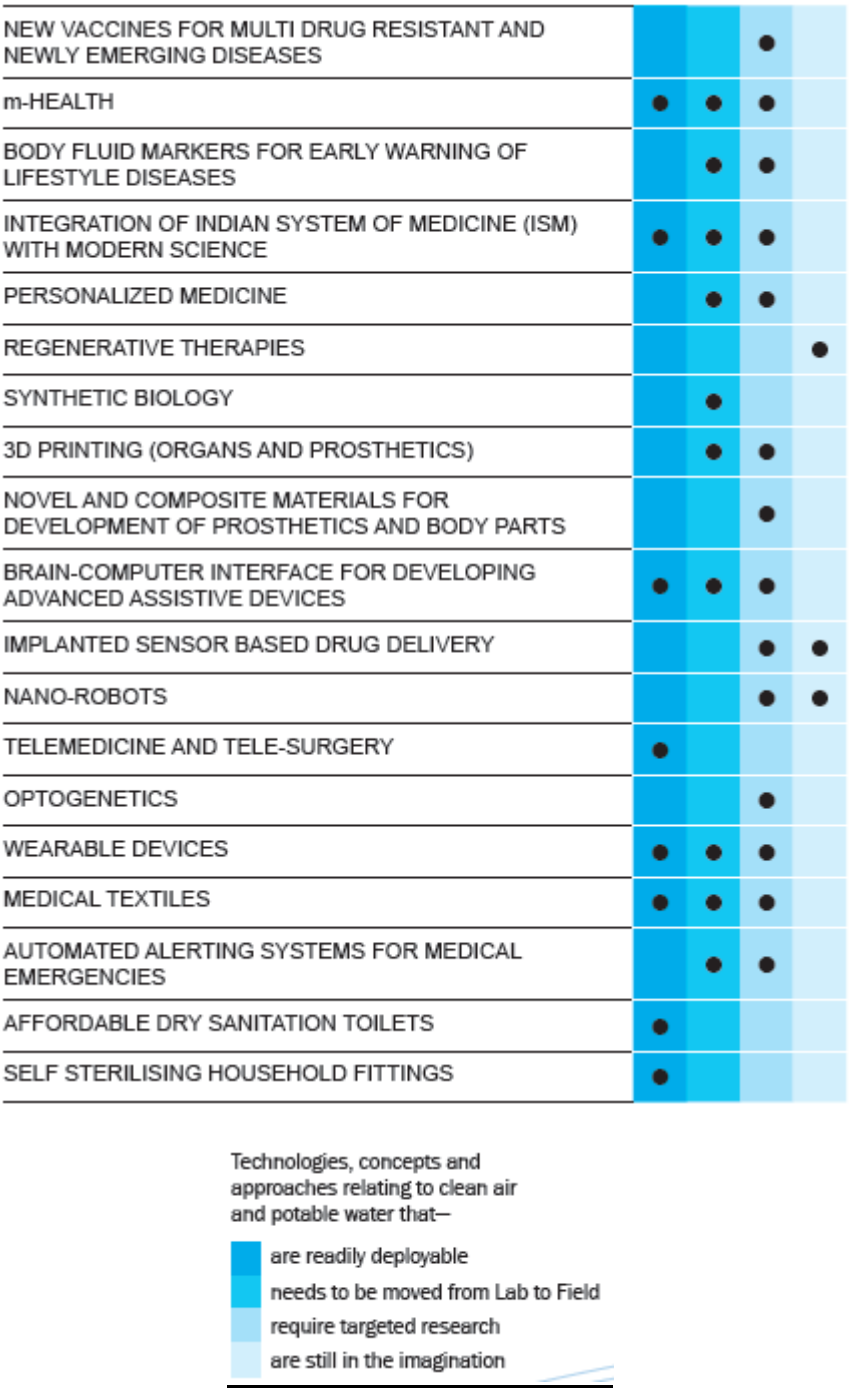
CLEAN AIR AND POTABLE WATER


ADVANCED CLEAN COAL TECHNOLOGIES
ALTERNATE FUEL BASED TRANSPORTATION
NOVEL PROPULSION TECHNOLOGIES
GREEN MANUFACTURING
INTELLIGENT TRANSPORTATION SYSTEM
LOW DUST CONSTRUCTION TECHNOLOGIES
REAL TIME DENSE SPATIAL AIR QUALITY MONITORING
REAL TIME AQUIFER MONITORING INCLUDING SALINITY INGRESS
INSTANT PORTABLE WATER QUALITY TESTING
AFFORDABLE DESALINATION TECHNOLOGY
MEMBRANE BASED WASTE WATER TREATMENT
AFFORDABLE DE-SILTING OF WATER BODIES
TECHNOLOGY FOR RUN-OFF CONTROL
SCALABLE POINT-OF-USE WATER TREATMENT TECHNOLOGY
DEW HARVESTING
IN-SITU WATER PURIFICATION IN PIPELINE
SELF HEALING PIPELINES
Technologies, concepts and approaches relating to clean air and potable water that—
are readily deployable
needs to be moved from Lab to Field
require targeted research
are still in the imagination

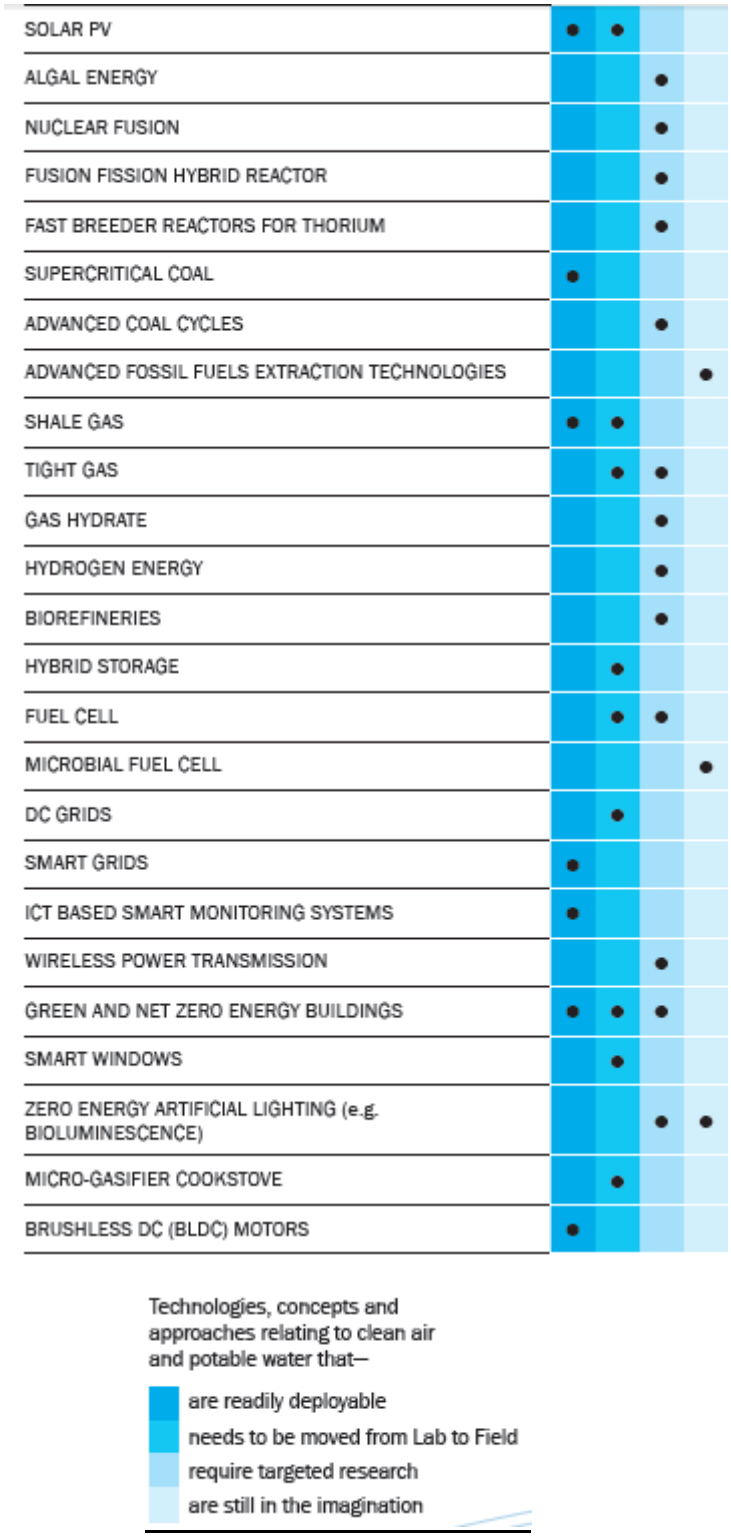
FOOD AND NUTRITIONAL SECURITY



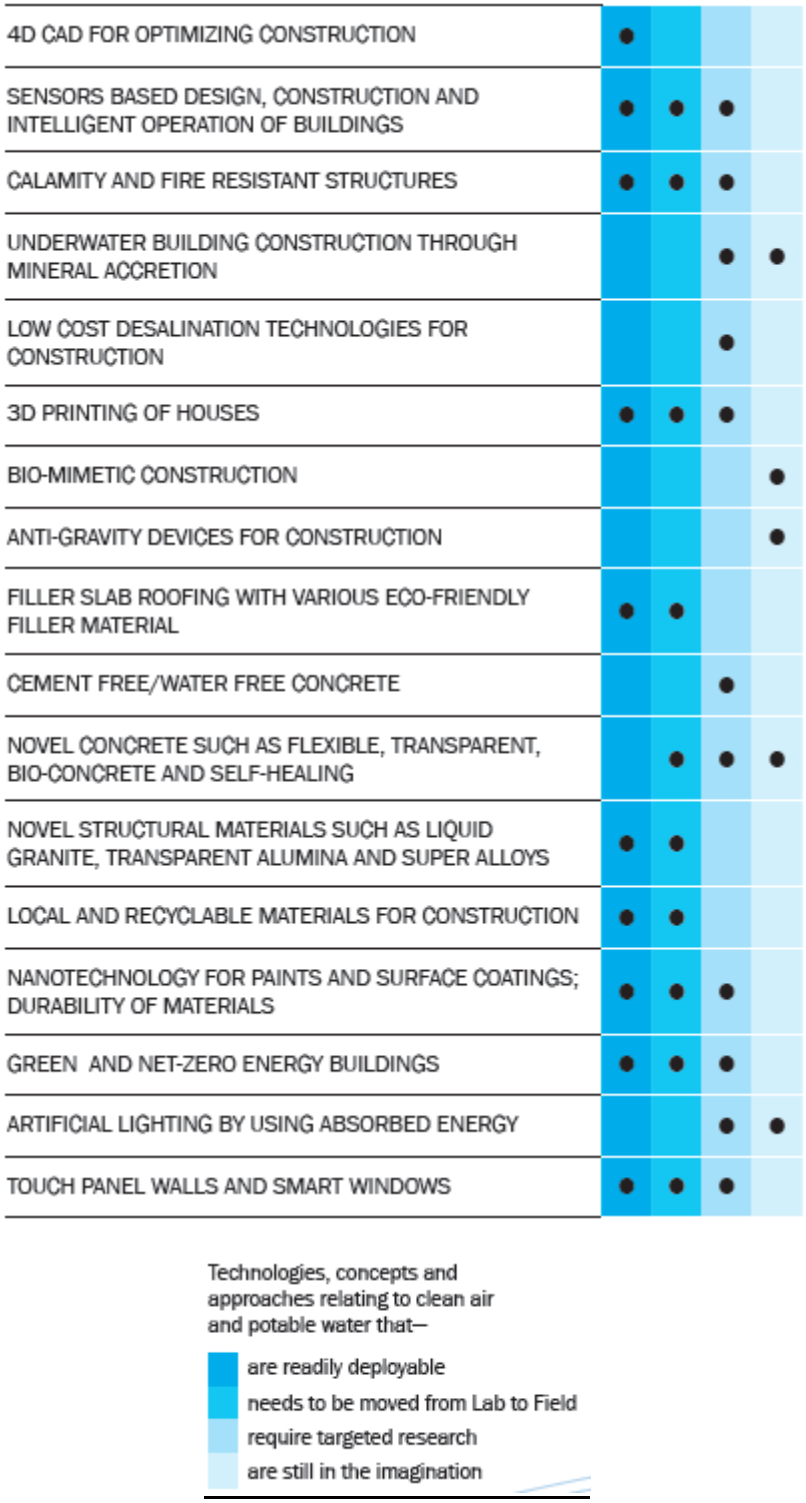
UNIVERSAL HEAKTHCARE AND PUBLIC HYGIENE



24x7 ENERGY


SOLAR PV
ALGAL ENERGY
NUCLEAR FUSION
FUSION FISSION HYBRID REACTOR
FAST BREEDER REACTORS FOR THORIUM
SUPERCRITICAL COAL
ADVANCED COAL CYCLES
ADVANCED FOSSIL FUELS EXTRACTION TECHNOLOGIES
SHALE GAS
TIGHT GAS
GAS HYDRATE
HYDROGEN ENERGY
BIOREFINERIES
HYBRID STORAGE
FUEL CELL
MICROBIAL FUEL CELL
DC GRIDS
SMART GRIDS
ICT BASED SMART MONITORING SYSTEMS
WIRELESS POWER TRANSMISSION
GREEN AND NET ZERO ENERGY BUILDINGS
SMART WINDOWS
ZERO ENERGY ARTIFICIAL LIGHTING (e.g. BIOLUMINESCENCE)
MICRO-GASIFIER COOKSTOVE
BRUSHLESS DC (BLDC) MOTORS
Technologies, concepts and approaches relating to clean air and potable water that—
are readily deployable
needs to be moved from Lab to Field
require targeted research
are still in the imagination

DECENT HABITAT



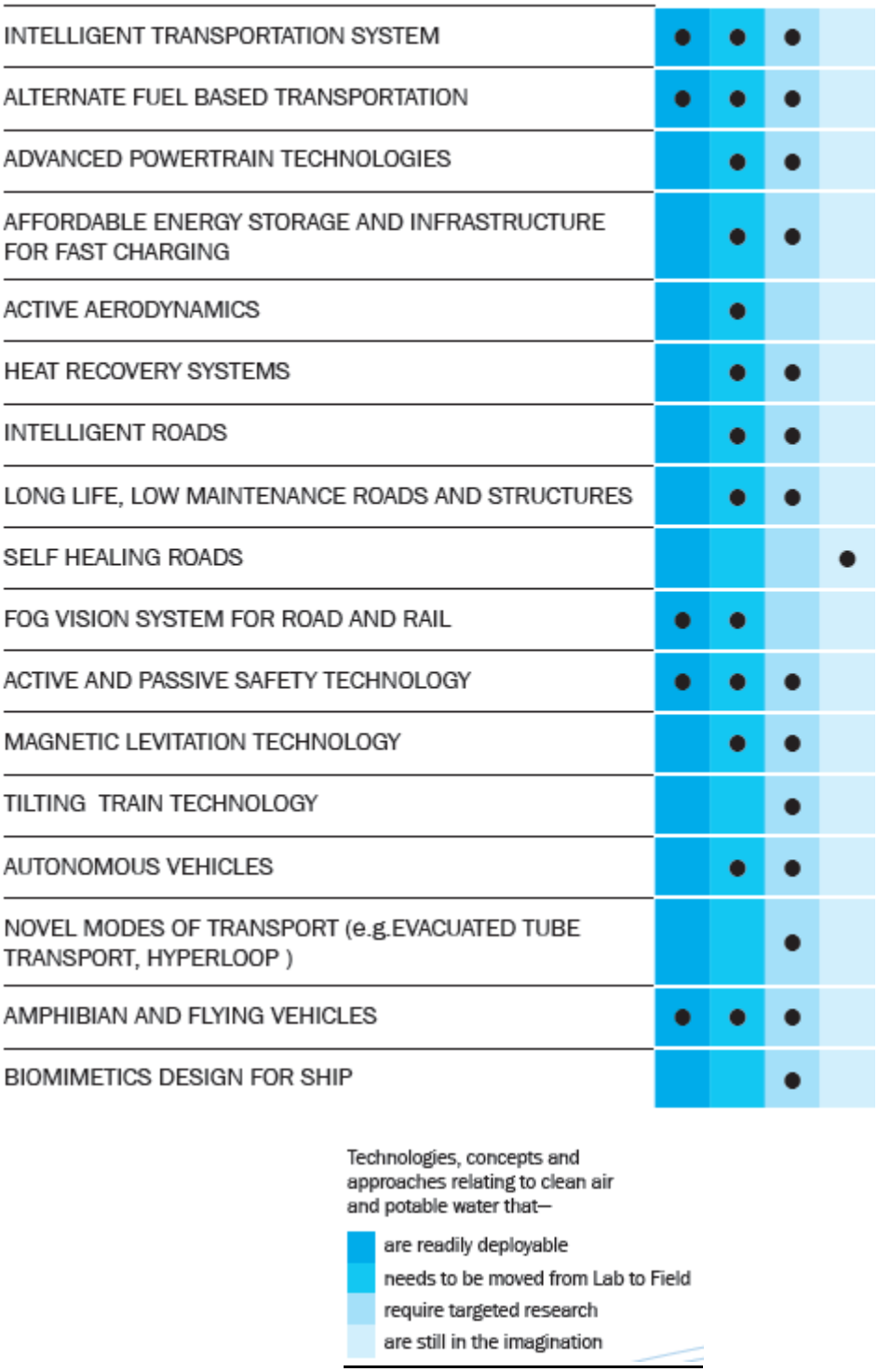
QUALUTY EDUCATION, LIVELIHOOD AND CREATIVE OPPORTUNITIES

MASSIVELY ONLINE OPEN COURSEWARE (MOOCS)	●	●		
GAMING/GAMIFICATION	●			
INTERACTIVE REMOTELY CONTROLLED LABORATORIES	●			
PERSONALISED VIRTUAL TEACHERS			●	
4G AND 5G COMMUNICATION	●	●		
IMMERSIVE VIRTUAL REALITY	●	●	●	
BRAIN COMPUTER INTERFACE AND MACHINE AUGMENTED COGNITION	●	●	●	●
WEARABLE DEVICES	●	●	●	
DIGITAL IDENTITY AND LEARNING ANALYTICS	●			
AUTOMATED EVALUATION AND ASSESSMENT SYSTEMS	●	●		
DIGITAL HOLOGRAPHY, 3D IMAGING AND VOLUMETRIC/3D DISPLAY	●	●		
3D PRINTING	●	●		
REAL TIME TRANSLATION FOR INDIAN LANGUAGES	●	●	●	

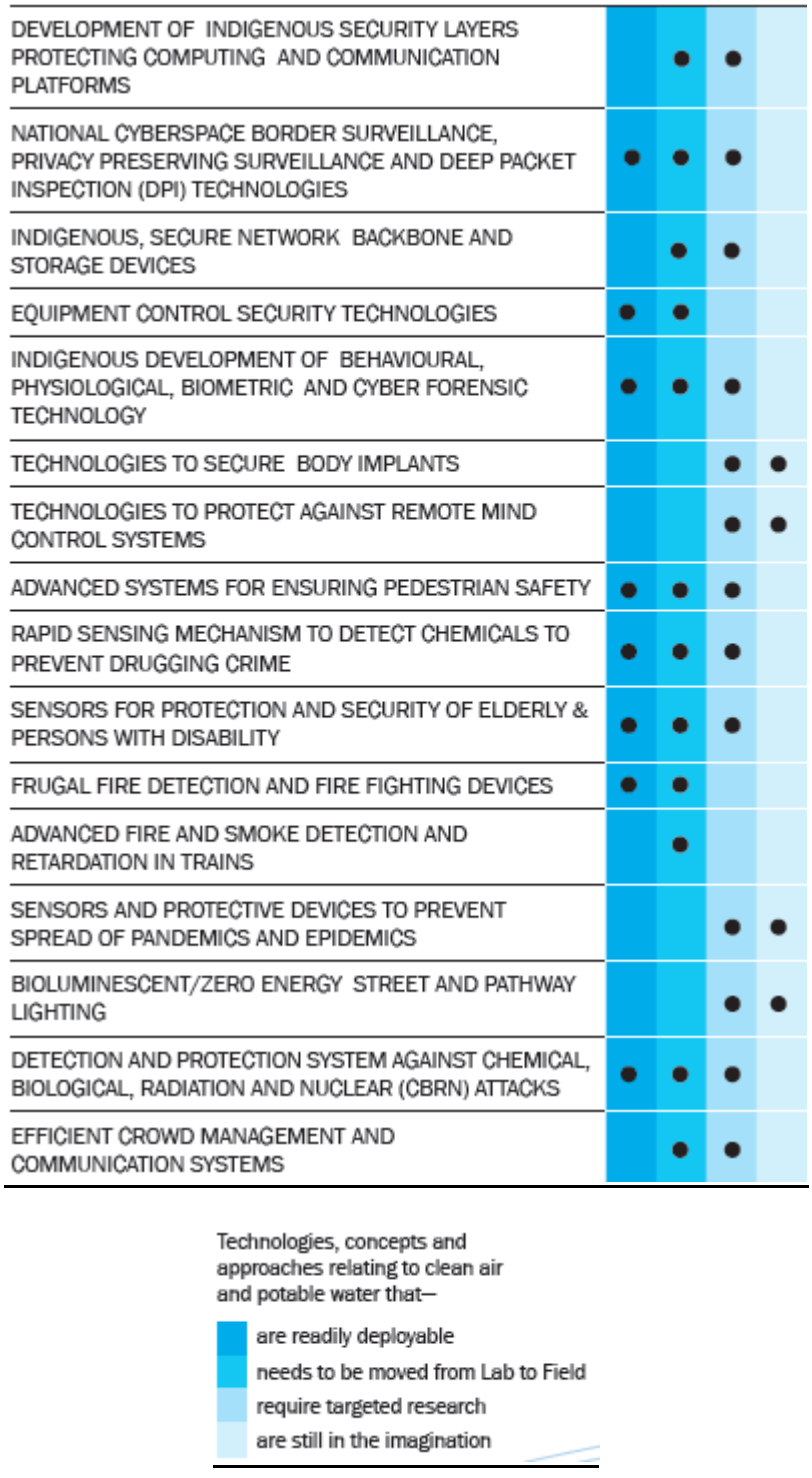
Technologies, concepts and approaches relating to clean air and potable water that—

- are readily deployable
- needs to be moved from Lab to Field
- require targeted research
- are still in the imagination

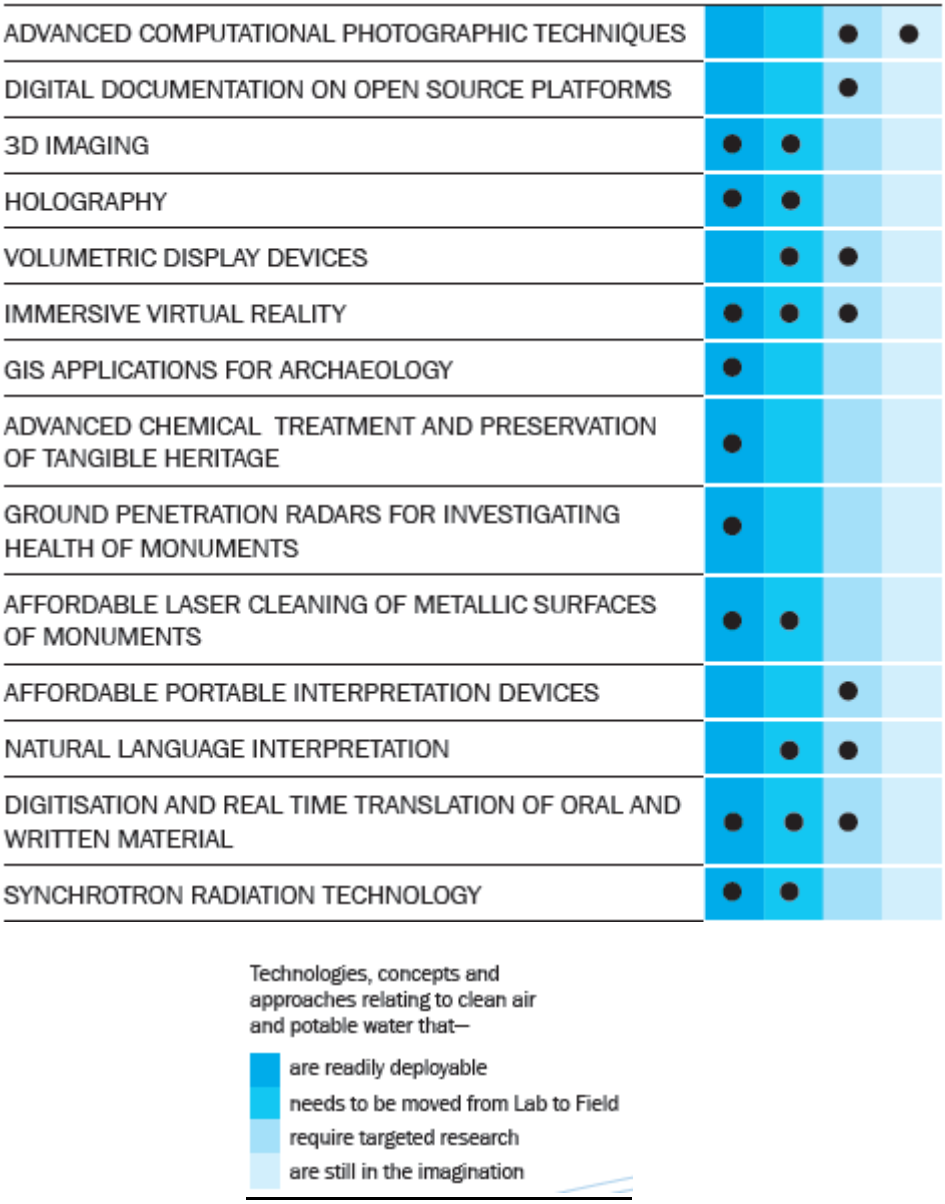
SAFE AND SPEEDY MOBILITY



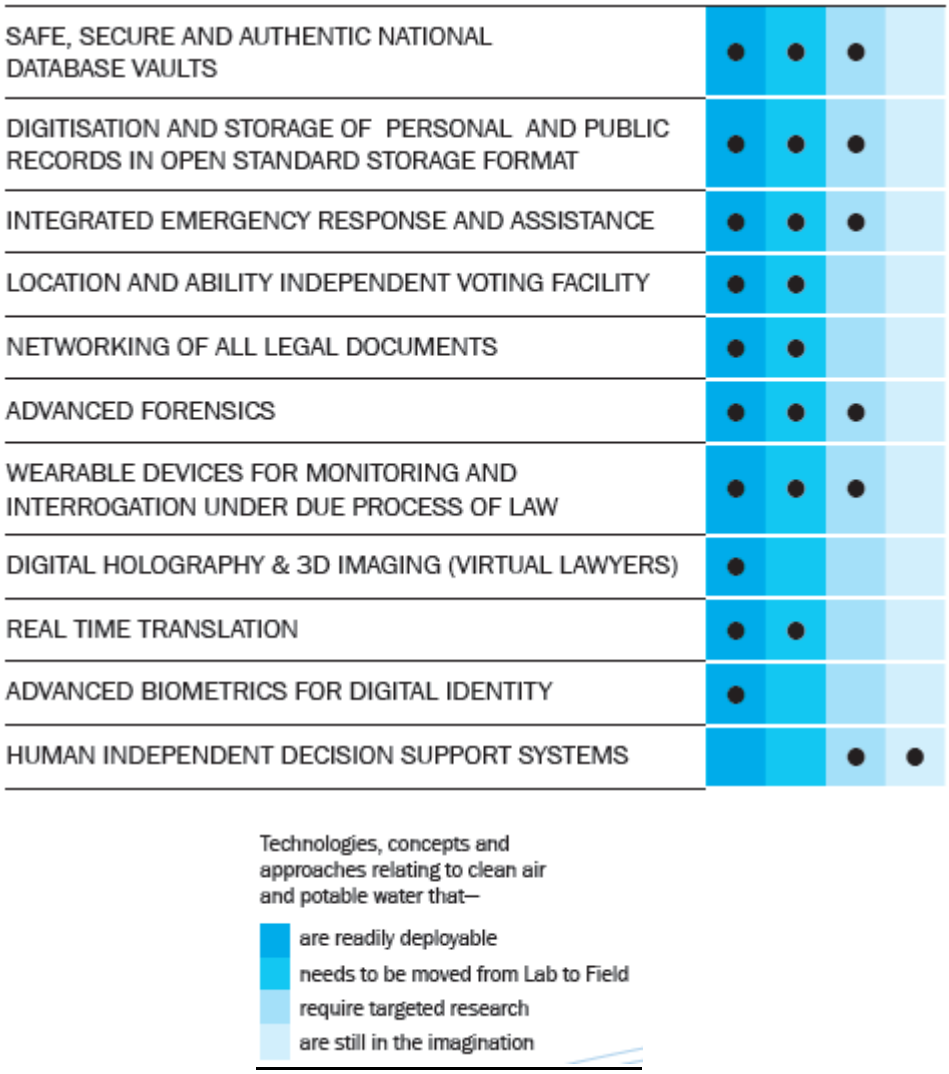
PUBLIC SAFETY AND NATIONAL SECURITY



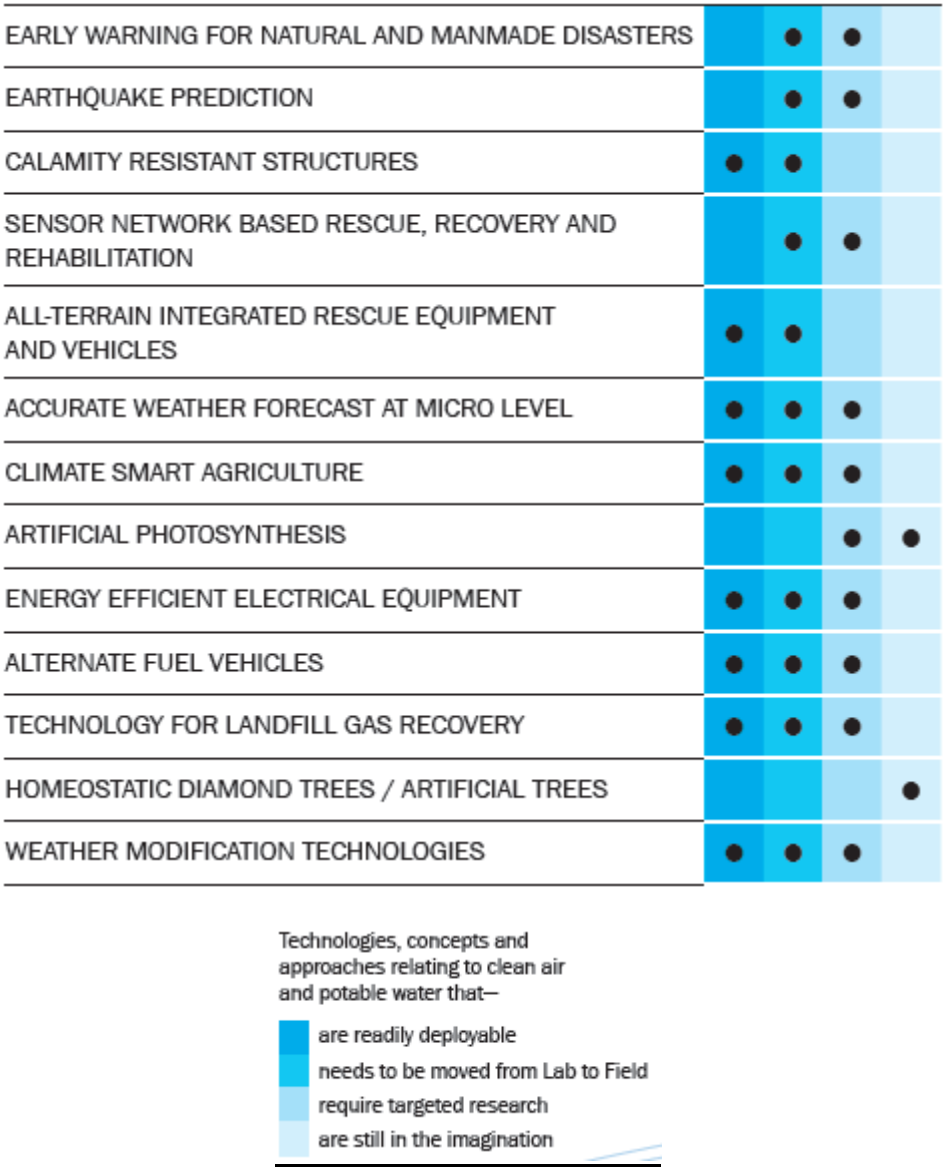
CULTURAL DIVERSITY AND VIBRANCY



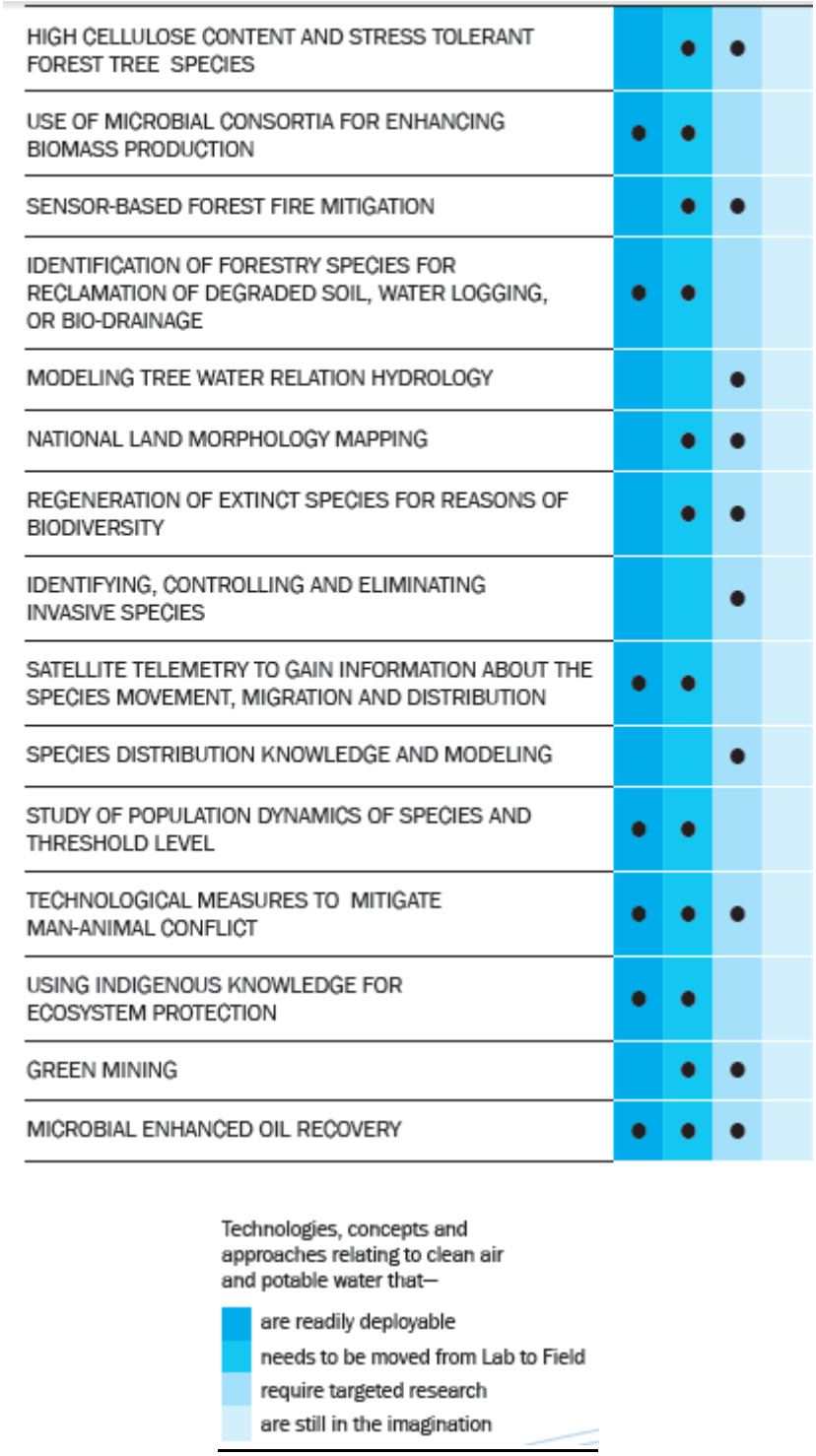
TRANSPARENT AND EFFECTIVE GOVERNANCE



DISASTER AND CLIMATE RESILIENCE



ECO-FRIENDLY CONSERVATION OF NATURAL RESOURCES



Tifac Grand Challenges

(Courtesy: TIFAC Technology Vision 2035)

1. Guaranteeing Nutritional Security And Eliminating Female and Child Anaemia: Nutritional security for all Indians should be our first Grand Challenge, with elimination of anaemia in women and children as our specific target. Unlike other markers of women's health, which have registered significant improvements over the India are showing a worsening trend. Currently over half of all Indian women of reproductive age are chronically anaemic. The price that individuals, families and the nation pay for the high incidence of female anaemia is enormous. Only a combination of targeted public health and nutrition initiatives, involving government, civil society and research institutions, will reverse this morbid trend.

2. Ensuring Quantity and Quality of Water in all Rivers and Aquatic Bodies: Cleaning our rivers would be an integral part of our second Grand Challenge. The quantity and quality of water in our rivers, inland waterways, water bodes and aquifers has an enormous impact upon the health and quality of life of all Indians. We will need to conceive of our river basins from source to sink as integrated biotic systems, and plan our hydraulic engineering schemes accordingly. Desalination technologies, which would reduce the pressure on our freshwater systems, would reduce the pressure on our freshwater systems, would be a crucial part of this Grand Challenge, as would the provision of 100% sanitation and sewage to all households.

3. Securing Critical Resources Commensurate with the size of our Country: Criticality of resources in the national context would depend on factors like potential constraints on supply, non-availability on Indian landmass and potential for performance enhancement. Economic and dependent on assured access to critical resources. With depleting earth resources, their uneven distribution and increasing global demand, this could eventually become a challenge of unprecedented dimensions. Assured access to required resource thus needs well targeted exploration efforts as well as sustaining diverse supply chains through concerted diplomatic and commercial linkage. The latter has go be a dynamic process alive to the evolving geopolitics. A key strategy in resource security management would be to maximize domestic value addition. This is also important for the economic growth of the country. While accessing critical resources should remain a matter of priority action, we also need to strength our technological capabilities to develop alternative that need less raw material resources or substitute them with more abundantly available alternatives. This calls for a dedicated long term program that encompasses relevant R&D and its translation to

commercialization. Development of fusion energy, fluid hydrocarbon substitutes, functional materials, low cost high technology products that deliver desired objectives more effectively and with minimum use of materials, are some examples of thrust areas that need to be pursued in a concerted manner. A standing framework that monitors and responds to resource security vulnerabilities that could emerge and implements a long term program to make the country self-reliant in terms of critical resources should be established.

4. Providing Learner Centric, Language Neutral and Holistic Education to all: Our fourth Grand Challenge relates to the provision of educational opportunities to all Indians. Technology makes it possible for us to move beyond the bane of predetermined, one-size-fits-all content; we can now provide individualized curriculum that is relevant to the needs, interests and talents of each individual learner. Assimilation of material deemed essential for all learners can be accomplished at different paces and sequences. Language need no longer be a barrier to learning. Education and skilling would then be liberating and empowe4ring, imparting the values to make complete human and social beings while being relevant in terms of life and livelihood possibilities.

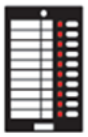
5. Understanding National Climate Patterns and adapting to them: Notwithstanding impressive strides taken as a result of Green Revolution, our agriculture is still principally dependent on the monsoon rains. Even slight alternation in its course or time table and the agricultural output along with its contribution to the GDP suffers badly. Granting that monsoon is a variable phenomenon making it difficult to chart its progress, we cannot afford to be at the mercy of fickle weather. The problem has been compounded further in recent years with worldwide-climate change having disturbed the weather routine to which we have become accustomed for decades. This cannot be allowed to continue as it can harm our development plans disastrously-All efforts would have to be made, therefore, to understand the national weather pattern along with global atmospheric conditions impacting on it, so as to be able to provide reliable forecasts at the micro level. This would require not only modernizing our weather forecast machinery but also designing newer models of prediction. |We will have to take simultaneous steps to impress on all stakeholders the necessity of adapting to the changed patterns. Grand as this challenge is, it is well within the potential of technological and human resources we have at our disposal.

6. Making India Non-Fossil fuel based: Presently, energy use at a level commensurate with high Human Development Index poses the twin challenge of energy resource sustainability and threat of climate change. Coal is the mainstay of our electricity supply and may come under severe

stress in a few decades. Most of our hydrocarbon needs are presently met through imports. In the business as usual mode, our energy import bill which is already very high is likely to become unmanageable. The Grand Challenge then is to be free from such heavy dependence on fossil energy. Luckily, our energy resource endowment in thorium, renewable energy (primarily solar) and as yet untapped hydro potential is quite favorable to this objective. Since there are a number of India specific challenges that are unlikely to be of priority interest to most other countries, we need focused indigenous efforts to develop and deploy these technologies. Technologies for production of electricity as well as fluid hydrocarbon substitutes would need to be developed. A comprehensive implementation structure to deal with policies, technology development and rapid large scale deployment of non-fossil energy in the country would have to be put in place.

7. Taking The Railway to Leh and Tawang: If the difficult Katra-Banihal stretch is completed by 2017, we would finally have a rail link to the Kashmir valley in our 70th year of independence. Our seventh Grand Challenge would be to push onwards toward Kargiland Leh, tunneling through the Great Himalayas. On the eastern flank of the Himalayas, we would also need to take the railway line across the Brahmaputra and all the way to Tawang. This Grand Challenge would be an order of magnitude more difficult than tunneling under the Pir Panjal range to Kashmir. Nevertheless, is strategic terms, these is no Grand Challenge more urgent than building a rail link connecting the rest of India to these important national peripheries.

8. Ensuring Location and Ability Independent Electoral and Financial Empowerment: Our eighth Grand Challenge would be to leverage technology to empower all Indians politically and financially irrespective of their location and ability. Holding free and fair election is a mammoth logistical task in our country, requiring massive and sustained contributions from our administrative and security personnel. Un fortunately, millions are not able to exercise their franchise as they are unable to reach a specific location either due to disability or other reasons. Many do not possess even the physical ability to press button or cast votes through paper ballots or other means. Technology can overcome these barriers and would empower each citizen politically and financially in real sense.



9. Developing Commercially Viable Decentralised and Distributed Energy for All: To ensure universal availability of quality power to all households and establishments, we will need innovative solutions for generation, transmission and distribution. While the present approach of

establishing centralized and large scale power generation facilities is a basic necessity for quickly addressing the energy availability short fall at the macro level, we will always be in catch up more for ensuring techno-commercial viability in urban pockets, rural and remote areas. To address this issue, we will require the development and integration of technologies that enable synchronous utilization of renewable energy sources, micro-generation facilities, smart grids, and extra energy efficient equipment. The Grande challenge will be execution of the above in a manner that is commercially sustainable, environmentally benign, weather and resource independent, and for all time to come

9. Ensuring Universal Eco-Friendly Waste Management: Of the several important initiatives that would be integral to our last Grand Challenge, perhaps the most important would be to provide modern sanitation facilities to 100% of our households. By 2035, automotive components and electronic devices would be ubiquitous, so ensuring their 100% recycling would be essential. All biodegradable wastes would be decomposed andconverted into energy, thereby eliminating large landfills on the edges of cities. Manufacturing processes would produce minimal waste, which would be inputs into other production cycles. India would be well on the path to becoming a zero waste economy.

Appendix

Letter from VC to Industries/Organisations

Greetings from University of Kerala. I write this in connection with improving research and innovation in University of Kerala. The University is now in a process of upgrading its quality. This letter is not for seeking funds, but for something more valuable to the University: *ideas for our researchers and students to take up as challenge.*

The University of Kerala's research programs are by and large a process of research training. Though it does produce new and useful knowledge, there is no effort to translate the research results to field. One of the reasons identified is that the research problem is chosen without concern for the field application. Therefore, the University is making an attempt to contact R & D organizations, Govt. Departments as well as Industries and compile a set of problems that they are interested in. This may involve a new process, product or material. Such a compilation would be a starting point to orient University's research to industry/business needs, which I am sure, you agree, is a key point in innovation.

I therefore request you to kindly propose problems of interest to your organization that can be taken up by students and researchers from our University. Scientists, technologists and managerial experts of your organisation may be asked to suggest this. Both minor and major problems can be suggested, without concern for facilities and funds, at this point of time. The compilation will be published by the University so as to trigger interest among research and post-graduate students of the University.

I request you to animate scientists, technologists, managerial experts and other professionals of your organization to cooperate with this socially useful attempt to create University- Industry Linkage. I look forward to your kind and valuable response.

With warm Regards,

Sincerely

Prof. P.K. Radhakrishnan

The links mentioned below are pointers to University's research and innovation profile.

1. Summaries of PhD research from the University in 2015
   http://www.iqac.keralauniversity.ac.in/docs/PhD_Summaries_V4-Final.pdf
2. Consultancy brochure of the University.
   http://www.iqac.keralauniversity.ac.in/docs/Consultancy_Brochure_Ver_16.pdf
3. Innovation in University of Kerala:
   http://www.iqac.keralauniversity.ac.in/docs/eBook_on_Uok_INNOVATION.pdf

Ideas obtained through Social Media

Comments & suggestions obtained

"Based on your professional and personal experiences, please spare some time to suggest what our Universities and Colleges should do as research. There are about 5000 PhD level researchers, 50,000 engineers and about 3 Lakh arts and science students doing projects at any point of time. If 1% can be useful to the society, that would mean 3500 useful things for the society. It could be something like "An effective way to stop overhead tanks from overflowing" OR "A way to improve the life of mosquito bats" OR "An efficient way to stack books in a small library" OR "Design a chair for people with back aches" OR "A way to reorganise exam paper marking to make it more time-efficient" OR "reusing pencil shavings as packing material" .... There could be mega suggestions or micro suggestions. You don't need to be an expert, and don't worry about workability of your suggestions. It can also be any subject area. This will be comped as citizen inputs...

Those working in industries/business can perhaps look at it like this: If someone is ready to do something free that will make your business better, what would u wish?"

Responses

Biji Tharakan Thomas (Via Social Media): I have my 'idea diary' with lot of projects/ products. Some I want to keep to convert "for profit" businesses. How about a "Fruits/Veggies" washer? Just like a mini desktop washing machine which will wash fruits and vegetable and leaves without damage but remove all dirt pesticides wax etc.

Jayan Chandrasekharan (Via Social Media): A series of workshop for university guides to spread "Wisconsin Idea" may be worth a try.
https://en.wikipedia.org/wiki/Wisconsin_Idea

Clif Kussmaul (Via Social Media): On improved educational methods to help more people, more quickly and efficiently, learn to think, solve problems, etc.

Prince Prasad (Via Social Media): Good research is all about improving society. But since our knowledge is very limited, we feel most of them are irrelevant. When Newton was doing research on gravitation, there were people who thought, his work is useless. Years after when you realize that an apple falling and a satellite orbiting obey Newton's law of gravitation, you realize the value of research. I think plenty of useful research is going on and I feel, our stress must be on how to facilitate quality research rather than choosing some topics.

Mahesh Thampy (Via Social Media): How young criminals and anti-socials are born, what to do to tap those wasted potentials.. the research would bring in wonders to the society.

Bhagyalekshmy Saraswathy (Via Social Media): Bringing up of modern children and society in a useful manner to both family and nation can be made a topic for research.

Dinesh Kumar .A (Via Social Media): I think we are not getting even 0.1% fruitful products or ideas from these researchers. If one can find out a chemical (already in our blood)which can attract mosquitoes, then we could easily kill them without the danger of allethren in mosquito repellent. (Comment: it is a killer idea - synthetic blood just to catch mosquitoes).

PeEm Ji (Via Social Media): UGC/AICTE sponsored research is a waste of time in India... What they find out is unfortunately useful only for some salary hike! Again the losers are students as their teachers won't get enough time to teach them! This research activity leads to academic decline only! All research has to done in research institutions, otherwise our educational institutions will become places of no use for students! (Comment: Teaching and Research are inseparable. We must try to make research useful to society. One of the ways is to take up problems that the society suggests, that create artificial problems and solve them. Pls suggest your wish projects)

Dr. Thrivikramji Kyth: (Via Social Media): Bring back the PhD adjudication process that existed in the early nineties or prior to that. Eliminating the foreign examiner from the adjudication panel was a watershed decision. Then started the quid pro quo in phD thesis adjudication. I recall a friends comment about adjudication. If you want to reject the thesis then you got to read it. Or else… With all Indian examiners now even the language is gone awry, leave alone the cut pate thing… So don't wait for other universities to emulate. Let this university in Trivandrum undo the damage done by the reform.

Dr. Thrivikramji Kyth: (Via Social Media): Ours is a nation with lots of street children growing up into adulthood. I wish somebody did take the initiative of building parallel bars and ring clusters distributed in different parts of the town but avoiding the lock key and gated system type of

B. Ramachandran Nair: (Via Social Media): Before launching a training program on large/massive scale, we normally go for a training for trainers. Similarly we should develop a cadre of guides. It is a herculean task.

Premsankar Chakkingal: (Via Social Media): Technology should applied to various sectors for social change. For example, Put GIS in all KSTRC bus so general public can track them easily ... Small Electronic devices for daily needs of farmers and rural workers . We should focus on electronic manufacturing - The fab labs in my college and other 21 fab labs planning to implement in Kerala will boost the rural electronic innovation ....

Jibin Thomas: (Via Social Media): There is lot of plastic waste getting generated every day. If we can develop a method/machine which can help recycle say plastic bottles (power, mould them in to something useful…eg. Interlocking bricks), I believe it will be a solution for a major social problem. If an affordable system is created which can be operated by a few people in a standalone model, then multiple units like this can create employment for many across different parts of state/country. Reduce plastic waste…and Create Employment locally!!!

Large number are people are migrating inside and outside the country for different reasons…some are voluntary…some are forced. Solutions that lower communication barriers can go a long way in reducing the problems due to migration. I will be more than willing to collaborate as we are working on certain mobile based software for translation, interpreting etc. based on social collaboration. Creating something that reduce barriers of inter-language communications can go a long way in enhancing understanding of other cultures and will surely help in the overall progress.

Jibin Thomas: (Via Social Media): a) A method for ranking the translators for correctness based on their contributions from a given period of time. b) A method for analyzing/identifying key patterns of what people are requesting translation c) ways of aiding language learning by means of such a platform. ..Can give more specifics if required.

Suja Nair: (Via Social Media): A very simple case - When a project is prepared to clean the drains, it stops with clearing the waste in the drains and keeping it just on the sides of the drain/road. And in the next day rain , the entire thing just falls into the drain again .

Don't we need to add this component into this project - to take away the removed waste being left on roadsides ? Somebody can study why this pattern is being followed and what can be done to avoid such situations - not much intellectual research needed, but it will be useful to the society as a whole.

Kevin Mathew Sunny: (Via Social Media): It would be a great thing if research can be fuelled into the social `Sciences`. Axioms of developing the society has to be fine-tuned, but the research towards this has been neglected both at the pre and post stages.

Anoop P. Ambika: (Via Social Media): Here is a list of wish projects 1. Quality Check Sticks for food products. A litmus paper/pregnancy detector kind needle which will change colour/scale if there is huge amount of heavy metals is a certain food products. 2. Vacuum controlled waste disposer. Train waste bins are often spilling over with cups by the time we reach Cochin from TVM. If there is a waste bin which will compress these plastics and papers using some vacuum pumping a small bin could hold a lot more waste 3. Wearable device to predict a fall. Before someone falls down because of a vertigo there are certain vitals that gets changed. If we can have a wearable device which could predict these, it will be a great help for the old age 4. Virtual reality teaching. If I have something like Ocular Rift for my math studies, why do I need a school.

Gopikrishan Gopalakrishnan: (Via Social Media): Bio gas plants in every 1 or 2 kms to collect and convert waste to bio gas and use it in say small tea stalls etc. or provide at subsidized rate to hotels which are ready to participate. Plant trees also on road side which can be fertilized from the slush. Automated cleaning robot for small canals and drainage pipes. Glass doubling up as solar panels which can extract energy form facades of buildings at least to light up the common areas. Cost effective automated parking solutions to de congest.

Chandran Parameswaran: (Via Social Media): If you look around through a designer's eye, one can see hundreds of things which need improvement. For example, there can be a standard design for signal posts. The present designs never stand straight, there will be many cables hanging on it. I think hardly any study has been done regarding the visibility of drivers, chances of errors in reading the lights etc.

Ahmed Thajudin: (Via Social Media): An important step in stopping "paid projects". Please try to put in a portal so that it is helpful for the faculty and students of engineering colleges and polytechnics. Out research centres (Kerala has research centres for every food grain, spice and vegetable) can also follow this.

Eldho Joy: (Via Social Media): Why not think about projects on "animal intelligence". For instance how ants follow a straight line path and carry twice its own wweight< Also, road accidents and the drugs and'drinking'?

Akhil S. Nair: (Via Social Media): There are a lot of projects and innovative ideas have been depicted on each State Science Exhibitions and at the district level. But these are not given much exploration at a practical zone.

Jacob Bijo: (Via Social Media): What about perfecting small scale domestic water purification systems that run on alte3rnate energy??? Many places in and around Kochi and Kuttanadu will require lots of them (not very sure of the southern parts) Several attempts are reported from our neighboring state in this field – based on nanotechnology.

Achuthsankar S. Nair: Can we have a low cost sensor developed to detect pesticides? Here is a use-case: You buy tomatoes. Take it home and put ½ a kg in ½ litre of water for 10 minutes. Now dip the sensor in the water, it should indicate the pesticide presence of the most prevalent type and indicate quantity also.

-A machine to extract the edible part of jack fruit (Chakka Polikkunna Yanthram).

UNIVERSITY OF KERALA

PUBLIC RELATIONS WING

PRESS CUTTING

Name of Paper : ദേശാഭിമാനി

Date of Issue : 29/7/2016 29/7/2016

Caption of News Item :

29/7/16

PUBLIC RELATIONS OFFICER

QUALITY IMPROVEMENT

KU receives innovative research ideas

EXPRESS NEWS SERVICE @ T'Puram

THE University of Kerala has received numerous innovative ideas on research from the industry and the academia as part of the institution's attempts to improve its quality.

The University had invited suggestions for research from organisations and general public. This was in line with a recommendation from the National Assessment and Accreditation Council (NAAC) that Universities should seek inputs from stakeholders on its activities.

Kerala Metals & Minerals Limited (KMML) Chavara has asked the University to take up the issue of handling over two lakh metric tonne of iron oxide and solid from Effluent Treatment Plant located in their premises.

The University also contacted alumni holding key positions across the world via e-mail. Dr Madan Thangavelu of University of Cambridge urged the University of Kerala to focus on multi-disciplinary research involving the biodiversity of the state.

Combining aspects of chemistry, botany, biotechnology, computing and Ayurveda was cited as an example of multi-disciplinary research.

Developing a mini desktop fruits/vegetables washer, low-cost sensor for detecting heavy metal in food,

low-cost sensors to detect food adulterants and low-cost domestic water purification were among the research suggestions the University received from social media.

The University has now asked the general public, organisations and movements for ideas on research. The suggestions can be sent to Director, Internal Quality Assurance Cell (IQAC), University Campus, Palayam, Thiruvananthapuram - 695034. Email ID: team.iqac@gmail.com. 29/7/16