

**Miranda House
University of Delhi**



**Department of Biotechnology
DBT Star College Scheme**

**Report
2016-19**

**Departments
Botany, Chemistry, Physics and Zoology**

Progress Report

1. Name of the College: **Miranda House**
2. Status (Govt./Govt. aided/Autonomous/Pvt): **Govt. aided**
3. Women's college or Co-educational: **Women's college**
4. Rural/ Urban: **Urban**
5. No. of Depts. Supported: **Four (Botany, Zoology, Chemistry, Physics)**
6. NAAC Ranking -**Grade A+ with CGPA 3.61 (2017); NIRF Rank 1 (2017, 2018, 2019)**
7. Details of extramural funding received:

College is recipient of institutional project grants (i) for establishment of DSKC (2008-2011); (ii) under DBT Star College Scheme for enhancement of science education (2011-19); and (ii) for organization of INSPIRE Internship Programme (2011-2018).

Research Projects: Individual faculty is encouraged to apply to various funding agencies for research grants. Over the last 10 years, 48 faculty members have been engaged in funded research projects as PI or Co-PI. Several projects are ongoing and several are completed.

DU Innovation and DU-Star Innovation Projects: College has successfully completed 11 DU Innovation Projects and 3 DU Star Innovation Projects. These have been possible with involvement of more than 50 faculty members and 250 UG students.

Research Projects and Funds Generated over Three Year Period (2016-19)

Research Projects	Ongoing		Completed	
	No.	Grant Rs. in lakh	No.	GrantRs. in lakh
Individual Major Research Project	4	610.696	9	1047.26
DU Innovation/Star Innovation Research Projects	-	-	15	330.95
DBT Star College Project	Phase-2	79.00	Phase-1	76.00
Research Fellows	2	24.61	1	4.00
Individual Minor Research Project	2	14	-	-
Total	9	728.306	26	1458.21

Please refer Enclosure 1 for detailed list of projects.

8. No. of applicants vs No. of seats in each department

University of Delhi has a Centralized Pre-Admission Form for Admission where the candidate can apply for a number of courses and colleges. A total of 1.50 lakh applications were received this year for all courses.

9. Number of students admitted year wise in different courses supported under the Star College Scheme

Course	2016-17		2017-18		2018-19	
	Sanctioned	Admitted	Sanctioned	Admitted	Sanctioned	Admitted
B.Sc. Life Sc.	35	39	35	37	35	33
Botany (H)	31	31	31	31	31	30
Chemistry (H)	62	87	62	76	62	60
Physics (H)	69	113	69	97	69	83
Zoology (H)	31	31	31	41	31	38

10. Change in the cut off percentage/admission

	5 years After grant		
	2016-17	2017-18	2018-19
Botany (H)	96.00	96.00	95.67
Zoology (H)	96.67	97.00	97.67
Chemistry (H)	96.67	96.67	96.67
Physics (H)	96.67	96.67	94.00
Life Science	95.00	95.33	95.33

11. Change in the dropout rate

Dropout rate in UG and PG (average of last two batches)

Given the education system, large number of students interested in pursuing professional courses, such as medicine or engineering, take admission in B. Sc. Programmes in colleges. Subsequently some gain admission in professional colleges and cancel their admission and leave Miranda House. Number of students that continue their studies in pure sciences has increased and there are no migrations to other colleges. The table below shows the number of dropouts against the number admitted in each course.

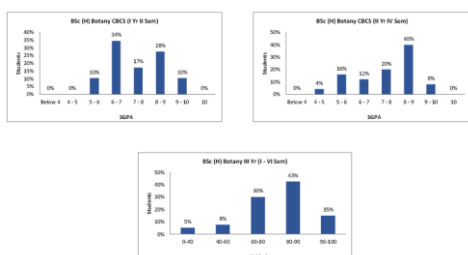
Dropout rate in UG and PG (average of last two batches)

UG	2.95	PG	7.90
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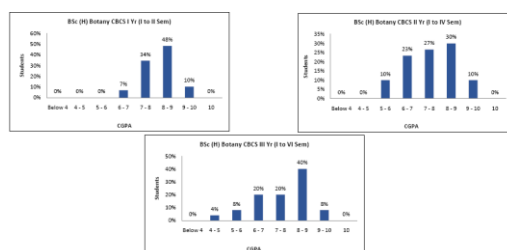
12. Data on Pass percentage (UG level)

Botany Honours

2016-17

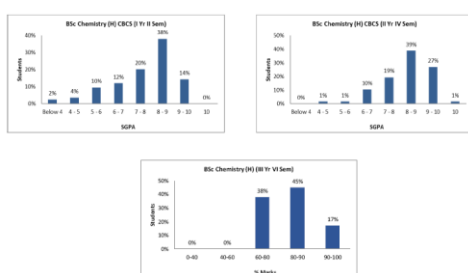


2017-18

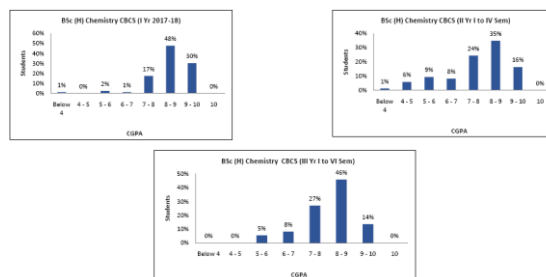


Chemistry Honours

2016-17



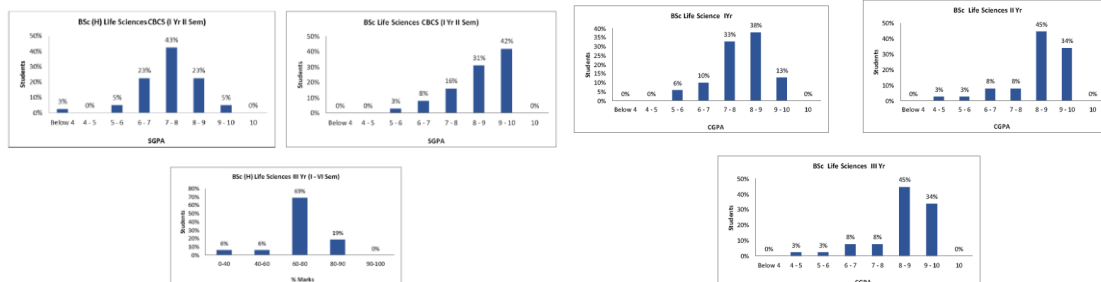
2017-18



Life Sciences Programme

2016-17

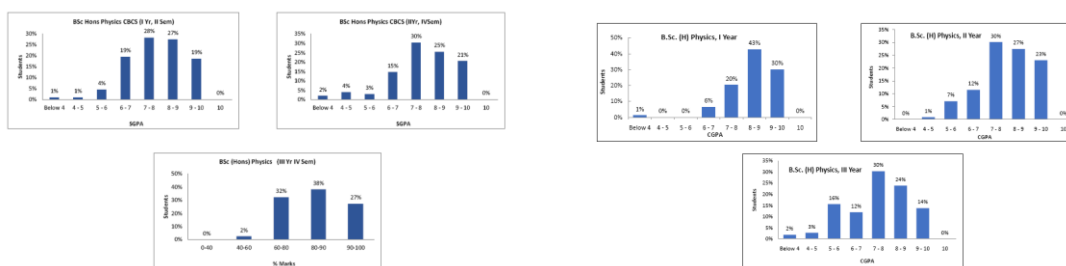
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Physics Honours

2016-17

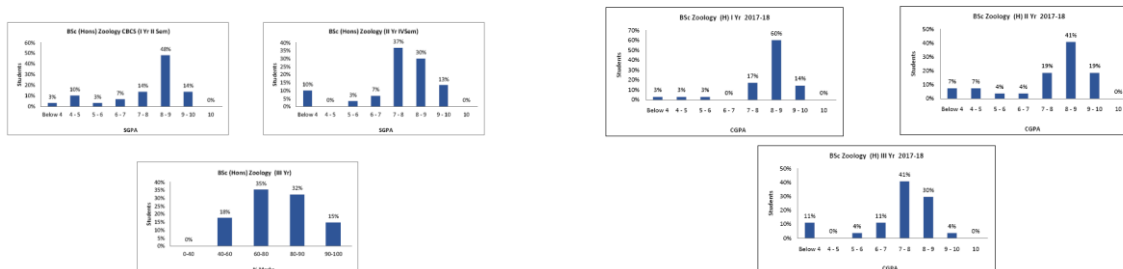
2017-18



Zoology Honours

2016-17

2017-18



13. How many students opted for PG courses

Consolidated Data of Progression of B Sc students of the Science Departments of MH (Botany, Chemistry, Physics, Life Sciences, and Zoology)

Academic Year	No. of Students enrolled in Science Dept.	No. of Students Passed out	No. of Students enrolled in PG courses*
2012	237	231	100
2013	290	287	105
2014	232	227	116
2015	214	204	115
2016	228	227	111
2017	253	251	165
2018	268	266	171

*The data is mainly about students taking admission in PG courses in DU like Masters in Botany, Chemistry, Physics, Zoology, Genetics, Microbiology, Biochemistry and Biomedical Sciences, Agrochemicals and Pest Management, Anthropology, Environmental studies, and Plant Molecular Biology.

Every year many students also move to other universities like NITs, IITs, IISERs, TIFR, NCBS, FRI, Jamia Millia, JNU, TERI and other Central and State Universities for post graduation and to other disciplines, like MBA, MCA, B.Ed and courses in biotechnology, biophysics etc. Nearly 30% of students passing out every year do masters outside DU.

14. List of additional practicals introduced

A number of new experiments and protocols were developed which are:

- Sonication of bacterial cells to extract recombinant proteins
- Protein purification by affinity chromatography
- Protein confirmation by SDS-polyacrylamide gel electrophoresis
- Detection of proteins by Western blotting
- Protein concentration determination by Bicinchoninic Acid (BCA) Assay
- Protein structure and homology modelling
- Sandwich ELISA for detection of antigens
- Immuno-electrophoresis of serum proteins
- Preparation of competent cells and plasmid DNA transformation
- Blue-White screening of recombinant bacterial colonies
- Determining the β -galactosidase activity expressed in recombinant *E.coli* strains by ONPG assay
- Primer designing and polymerase chain reaction of genes
- Demonstration of Southern blotting
- Disc Diffusion Assay for antibiotic resistance

- Preparation of *E.coli* growth curve
- Demonstration of DNA fingerprinting
- Demonstration of animal cell culture
- Developmental Biology of Zebra Fish
- Developmental Biology of Drosophila
- Rearing of Silk Worm
- Immunoinformatics for Vaccine Design
- Immunophenotyping-Flow Cytometry
- MHC- PCR typing
- Evolution of Darwin Finches through simulation
- Campus Bird Count
- Metagenomic DNA isolation from environmental bacteria
- Isolation of genomic DNA of cauliflower by spooling method
- Estimation of DNA using diphenylamine reagent
- Isolation of genomic DNA of *E. coli*
- Separation of nitrogenous bases by paper chromatography
- Separation of sugars by thin layer chromatography
- Separation of chloroplast pigments by column chromatography
- Measurement of 10Dq by spectrophotometric method
- Verification of spectrochemical series
- Preparation of acetylacetonato complexes of Cu(II) and Fe(III) and finding their λ_{max}
- Controlled synthesis of two copper oxalate hydrate complexes: kinetic versus thermodynamic factors
- Synthesis of ammine complex of Ni(II) and its ligand exchange reaction (with DMG, acetylacetonone) by substitution method
- Extraction of caffeine from tea leaves
- Preparation of urea-formaldehyde resin
- Preparation of sodium polyacrylate
- Isolation of ibuprofen and p-actylaminophenol from Combiflam by solvent extraction and their purity analysis by melting point and TLC
- Estimation of vitamin C using 2,6-dichlorophenol indophenol dye
- Estimation of glucose using Fehling's solution
- Synthesis of silver nanoparticles and their spectroscopic characterization
- Preparation and characterization of polyacrylamide hydrogels by co-precipitation method
- Determination of tin and lead content in solder by complexometric titration
- Spectroscopic determination of manganese in steel
- Scilab based simulations experiments based on Mathematical Physics problems like
- Determine output characteristics of a LVDT and measure displacement using LVDT
- Measurement of strain using strain gauge
- Measurement of level using capacitive transducer
- Study of distance measurement using ultrasonic transducer
- Calibrate semiconductor type temperature sensor (AD590, LM35, or LM75)
- To measure the change in temperature of ambient using Resistance Temperature Device

(RTD)

- Electron Spin Resonance
- Gamma Spectroscopy and Compton Effect Experiment
- QuarkNet cosmic ray detectors for cosmic ray and muon study

15. List of minor projects implemented, name of students and supervisor

Please Refer Enclosure 2

16. Faculty improvement activities such as training courses, seminars etc conducted and their impact

Please Refer Enclosure 3

17. Outreach activities conducted and their impact/ follow-up

Please Refer Enclosure 4

18. Any outstanding achievement by student/faculty (merit, award, research paper, presentation in national/international conference/ etc; full citation to be provided)

Publication profile of the faculty members/ Student Publications in Peer Reviewed Journals

Refer Enclosure 5

Awards:

- The college received the Dr. Arun Arora 50 Best Educational Institutes of India Award at the World Education Congress, 23 November 2017, Mumbai; and the National Skill Resources Development Award at the National Skill Development Summit 2017, IIC New Delhi, on 3 October 2017.
- Dr. Monika Tomar, Department of Physics was the only college teacher to receive the Teaching Excellence Award on the DU Annual Day in May 2016.
- Dr. Pratibha Jolly, GIREP 50th Anniversary Medal presented at the 50th Anniversary GIREP Seminar, Research-based proposals for improving physics teaching and learning – focus on laboratory work, JU Institute of Physics, Jagiellonian University, Kraków, Poland, 30 August to 3 September 2016. (GIREP: Groupe International de Recherche sur l'Enseignement de la Physique, International Research Group on Physics Teaching).
- Dr. Pratibha Jolly, Honour for Life time Contribution to Physics Education in the Country by Indian Association of Physics Teachers (Regional Council - Delhi and

Haryana), awarded at the 4th Annual Convention of IAPT Regional Chapter RC1 on 23 July 2016.

- Dr. Pratibha Jolly, Member, Programme Committee, *14th International Conference on Education and Training on Optics and Photonics (ETOP 2017)*, Zhejiang University, Hangzhou, China, 29-31 May 2017.
- Dr. Pratibha Jolly, Member, Associate International Committee, ICPE-GIREP 2nd World Conference on Physics Education (WCPE), *Contemporary Science Education and Challenges in the Present Society: Perspectives in Physics Teaching and Learning*, São Paulo, Brazil, 11-15 July 2016.
- Dr Mallika Pathak, Chemistry has received a Certificate of Most Promising Innovation for Innovation Project (MH-306) ‘Design of Affordable Water Purification devices using Green and Ecofriendly Silver Nanoparticles’ at 93rd Annual Convocation of University of Delhi held on 19 November 2016.
- Dr. Pratibha Jolly received the First Buti Foundation Lecture Award 2017 instituted by the National Academy of Sciences India (NASI), Allahabad. She was awarded the World Economic Forum –Women of the Decade in Academia Award on 13 May 2017; Women Economic Forum 2017.
- Dr. Pratibha Jolly was nominated to the Executive Committee of the National Assessment and Accreditation Council (NAAC) w.e.f. 24 May 2017;
- Dr. Pratibha Jolly is Member, National Task Force and Expert Committee on Star College Scheme, Department of Biotechnology (DBT), July 2017; Member, the National Academic Committee for supervision of National Children’s Science Congress, Department of Science and Technology, April 2017; Member, Scientific Review Committee for Initiative for Research and Innovation in Science (IRIS) Programme, INTEL DST Initiative, April 2017 for three years.
- Dr. Kalawati Saini received the International Association of Advance Materials Scientist Medal, 2017.
- Dr. Monika Sharma, Department of Zoology was awarded with the Bill and Melinda Gates Foundation Global Health Travel Award for attending and presenting her paper at the A3 Tuberculosis: Mechanisms, Pathogenesis and Treatment conference held at Banff, Alberta, Canada, 17 – 21 January 2019.

19. List of Short term training courses/workshops conducted for students and faculty, including title, duration, no. of beneficiaries

Refer Enclosure 6

20. Guest Lectures (details like name of scientist, topic, no. of students)

Refer Enclosure 7

21. Visits to industries, institutes etc (name of place, duration of visit and no. of students)

The following visits were conducted for educational purposes to give students an enhanced learning experience:

- Visit to a few shallow man-made lakes in Delhi i.e., Sanjay Lake (Mayur Vihar), Old Fort Lake (Mathura Road) and Naini Lake (Model Town) entitled *Limnological studies on shallow lakes in Delhi* was organized on 1 February 2017. Seventeen students of B.Sc. (H) Zoology III year studying Environmental Management paper went for the collection of water, plankton and macrophyte samples from the lakes
- Visit to attend lecture organized by Cell Press – TNQ India Distinguished Lectureship Series 2017 lecture of Professor Mary-Claire King on "Understanding Inherited Breast and Ovarian Cancer: From Gene Discovery to Precision Medicine and Public Health" on 24 February 2017 by students of B.Sc. (H) Zoology II and III year.
- Visit to the Neela Hauz Biodiversity Park on 29 March 2017 by 60 students of B.Sc. Life Sciences I and III Year, and B.Sc. (Hons) II Year with five teachers and two laboratory staff.
- Visit to the *Indira Paryavaran Bhawan*, the Ministry of Environment, Jorbagh Road on 18 April 2017 by 40 students, six faculty members and one member of the laboratory staff of Department of Chemistry
- Visit to THISTI, NCR Biotech Science Cluster, Faridabad, by a group of 35 students from across all three years of life Sciences and 3 teachers on September 22, 2017
- Visit to Shree Cement at Beawer, Ajmer district, Rajasthan, the largest cement manufacturing factories in North India, by 31 students from across all three years of Chemistry Honours with 2 faculty members 2 Laboratory Staff from 22-25 September 2017.
- Visit to Aravali Biodiversity Park, by 35 students of B.Sc. (Hons) Zoology, two teachers and two laboratory staff on 6 November 2017.
- Visit to Mukhteshwar, Kausani, Nainital and Jim Corbett National Park by 30 students of B.Sc. (Hons) Botany, two teachers and one laboratory staff from 23 to 28 February 2018.
- Field visit to Sewage Treatment Plant of Delhi Jal Board at Kondli, Delhi by students of B.Sc. (Hons) Botany 3rd year as part of their DSE paper on Industrial Microbiology on 28 March, 2018.
- Trip to Indian Agricultural Research Institute (IARI, PUSA campus) by B.Sc. (Hons) Botany 2nd year as a part of their SEC paper on Biofertilizer on 5 April, 2018.
- Trip to Dalhousie, Khajjiar and McLeodganj by B.Sc. (Hons) Botany to appreciate ecological aspects of the fragile mountain ecosystems from 5-10 October, 2018
- Visit to Regional Centre for Biotechnology (RCB) NCR Biotech Science Cluster, 3rd Milestone, Faridabad-Gurgaon Expressway, Faridabad (NCR Delhi), India by 22 students of B.Sc. (Botany, Chemistry, Life Science and Zoology) and 3 faculty members on 24th September, 2018 to attend the RCB Open Day Outreach Program under India International Science Festival (IISF) on 24th September, 2018.

- Visit to Aravali Biodiversity Park, by 35 students of B.Sc. (Hons) Zoology, two teachers and two laboratory staff on 29 October 2018.
- Visit to the India International Centre, Quadrangle Garden and exhibits for exhibition on women scientists titled: "Celebrating Indian Women in Science: the Incredible Journey" by 40 students and 6 faculty on 13 March, 2019.
- An educational trip to the Yamuna Biodiversity Park, Delhi by students of B.Sc. (Hons) II year accompanied by three teachers and two laboratory staff on 15 March 2019.
- Visit to the Regional Sericultural Research Station, Sahaspur and Wildlife Institute of India (WII), Chandrabani, Dehradun, Uttarakhand, India by 74 students, 5 teaching staffs and 3 non-teaching staffs for the fourth semester Sericulture paper of B.Sc. Hons and LS; and sixth semester Wildlife Conservation paper of B.Sc. Hons on 27-30 March, 2019.
- Visit to Sulabh International Social Service by students of B.Sc. (Hons) Botany 3rd year on 29 March 2019.
- Visit to IARI, Pusa Campus At IARI by students of B.Sc. (Hons) Botany to have a first-hand experience on Blue-Green algal culture as well as other aspects biofertilizers on 29 March 2019.

22. List of Lab manuals/SOPs generated for all participating departments

Laboratory manuals have been designed and e resources have been created and generated for all the workshops for teachers and students listed date wise in a multidisciplinary context in Point No. 19.

23. Feedback mechanism adopted (to be indicated in term of how the quality of teaching and hands on training improved)

Participating Departments and faculty members collect student feedback through informal channels or survey forms and analyzed to improve the programme further. Feedback was also taken from Advisory committee members to improve the overall functioning of the scheme.

24. Any special innovative approach adopted by the college in improving the UG education

Add-on Courses, Skill Development Courses and Short Duration Certificate Courses

In addition to formal degree programmes, the college also rolled out a number of Add-on Courses, Skill Development Courses and Short Duration Certificate Courses. The courses aim to (i) fill conceptual lacunae in existing courses; (ii) provide remedial instruction or prerequisite knowledge as do the bridge courses; (iii) impart life skills such as in language and communication; (iv) enhance employability skills in identified sectors in accordance with national policies; (v) introduce students to knowledge on the frontiers, preparing

them early for a research career; (vi) promote internationalization of syllabus and pedagogy; and (vii) promote bilateral exchange programmes with prestigious international institutes of higher learning, giving students an exposure to a globalizing world.

25. A summary on “how the Scheme helped in strengthening of the UG education and what would not have been possible without this” (not more than 1000 characters)

The grant by DBT has been of immense benefit to the college and helped us to acquire NIRF Rank 1 for three consecutive years.

The DBT Star College Scheme has provided a platform to enlarge and enhance the activities already being undertaken at Miranda House under the aegis of D S Kothari Centre for Research and Innovation in Science Education established at Miranda House since 2008. The well established project labs for undergraduate students allow us to engage students in research activities.

- The grant from DBT has not only helped the college to procure high end equipment, glassware and chemicals but has also helped us to repair the existing instruments for future use. The number of students participating in the summer camps, workshops has increased drastically
- It has helped students to have hands on exposure and experience in basic techniques ranging from molecular cloning and modeling, tissue culture, immunology, fabrication of nanoparticles (gold, silver, ZNO, SiO₂) and usage of latest ICT tools. It helped build their conceptual understanding of the subject
- The grant has provided a platform for the capacity building of teachers in learning newer scientific domains such as (a) integrating hands on experiments with multimedia resources (b) Genomics (c) Green Chemistry (d) Nanotechnology (e) Flow Cytometry and cell sorting (f) Understanding of Ultrasonic and (g) Advanced Robotics
- Due to the training received under the DBT Star College Scheme, the science faculty of the college has acquired the competence to share knowledge for improving undergraduate science teaching in the laboratories
- Students are expressing excitement and interest in research as they are now exposed to various aspects of research at undergraduate level.
- They are participating in National and International conferences/workshops and presenting their work there.

26. Suggestions/feedback for improving the scheme

From the success of various initiatives in which the college participates through DS Kothari Centre for Research and Innovation in Science Education and the DBT leads us to suggest the following ideas for enhancing the impact of DBT Star College Scheme:

- Establishment of a portal/website for interaction between the participating institutions with networking features for exchanging ideas, inputs, resources and information
- Sharing of resources, technology between participating institutions so that infrastructure created can be utilized for student benefit
- Development of curricular products and packages by the participating departments
- Institution of awards to encourage teachers and students to devote time for research as an incentive.

List of Enclosures

1. **Details of extramural funding received**
2. **List of minor projects implemented**
3. **Faculty improvement activities such as training courses, seminars etc conducted**
4. **Outreach activities conducted**
5. **Publication profile of the faculty members/ Student Publications in Peer Reviewed Journals/in conference proceedings**
6. **List of Short term training courses/workshops conducted for students**
7. **List of Guest Lectures**