Internal Review Report

Department of Chemistry
Indian Institute of Technology Delhi

March 2014

Table of Contents

Section 1

CURRICULUM

1.1 List of degree programmes offered – PG and enrollment

Level	Programme Name	Sanctioned strength
PG	M.Sc. Chemistry	54
	M.Tech. in Molecular Engineering: Chemical Synthesis and Analysis	20
	Ph.D.	150

Number of students graduated (2009-2013)

Year	M.Sc.	M. Tech.	Ph.D.
2009	27	-	18
2010	35	5	13
2011	33	8	15
2012	44	7	19
2013	49	7	8

Number of students currently on roll (October 2013)

M.Sc.	46 + 50 = 96
M.Tech.	10 + 17 = 27
Ph.D.	148

1.2 Consistency of curricula with academic vision of the department

The Department of Chemistry at IIT Delhi is recognized for its excellence in teaching and research in chemistry in India and abroad. An important mandate is to provide a comprehensive, relevant curriculum at undergraduate and post graduate levels to create quality human resource for careers in academia, industry and government. Currently, the Department offers two unique postgraduate programs (two years M. Sc. degree in Chemistry with three theory and two laboratory courses in biochemistry and an M.Tech. degree in Molecular Engineering - Chemical synthesis and analysis) and a Doctoral program. A number of graduates succeed in national eligibility tests and are admitted to Ph. D. programs in top institutes/universities in India/abroad. A significant number of graduates find employment in chemistry R&D industry in India. The faculty is committed to periodic curriculum revisions and to the introduction of a variety of teaching methods including current and emerging pedagogies that address the particular needs of a diverse student body. The faculty also integrates their research expertise into the different courses and projects as much as possible and regularly engages in mentoring undergraduate, post graduate and distinguished high school students as an integral part of their academic activities.

1.3 Quality of programmes

(a) **Periodicity of curriculum review of PG courses**

The department regularly participates in the Institute-wide Curriculum Review process, which happens once in a decade. In addition, new courses are introduced and existing ones modified when new research areas open up. A new M.Tech. programme was initiated in 2009.

(b) **Mechanism for review at UG and PG level**

Follows general guidelines prescribed by Institute academic bodies constituted for such purpose. All stake holders (students/faculty/alumni/employers) contribute to this activity.

(c) **Course work for each M.Sc., M.Tech. and Ph.D. programme**

Program	Core	Electives (Program and Open)	Total
M.Sc.	72	18	90
M.Tech.	41	13+6	60
Ph.D.*	2	2	12*

* M.Tech. students admitted to Ph.D. programme require only 6 credits.

(d) **Pre-PhD courses offered**

The core M. Tech. courses CYL695, CYL725, CYL729 and the programme electives CYL668, CYL677, CYL686, CYL687 , CYL703, CYL733& CYL726 are open to Ph. D. students as Pre PhD courses.

(e) **New advanced Masters/ Pre-PhD courses introduced in last 5yrs**

(i) CYL703: Spectrochemical Methods
(ii) CYL733: Chemistry of Industrial catalysts

(f) **Overlap between courses(c) and (d) & (e) including opening latter to UG**

Core M.Tech. courses CYL695, CYL703, CYL733, CYL725, CYL729 and programme electives CYL668, CYL677, CYL686, CYL687 & CYL726 are also open to M.Sc. students as electives.

(g) **Seminar series (weekly/regular)**

Partial list provided.

(h) **Placement details (2009-2013)**

Ph.D

Year	Faculty (Univ./colleges)	RA/Post Docs	Scientist in National Labs	Industry
2009	3	6	3	3
2010	6		2	
2011	7	4	5	3
2012	2	8	2	2
2013	2	3	-	1

M.Tech. A few have joined Industry and the remaining are pursuing Ph.D. programme.

M.Sc. Around 70% are pursuing Ph.D. programme in India/abroad; 10% are employed.

(i) **Relevance of PG programmes to employers**

CGPA, qualification in national level tests (GATE, CSIR/UGC/DBT etc.) and quality of project work in the Masters level are generally considered as markers for admission to various PhD programmes in India/abroad.

Good quality publications and analytical/computational skills in appropriate areas.

M.Sc. in Chemistry (Two years programme)

The overall credit structure

Category	PC	PE	OC	TOTAL
Credits	72	12	6	90

Programme Core (PC)

S.No.	COURSE	L	T	P	TOTAL
1.	CYD660 Project Part 1 (Minor)	0	0	6	3
2.	CYD670 Project Part 2 (Major)	0	0	16	8
3.	CYL501 Molecular Thermodynamics	3	0	0	3
4.	CYL502 Stereochemistry and Organic Reaction Mechanisms	3	0	0	3
5.	CYL503 Main Group Chemistry and Inorganic Solids	3	0	0	3
6.	Biochemistry I	3	0	0	3
7.	CYL505 Instrumental Methods of Analysis	3	0	0	3
8	CYL561 Quantum Chemistry	3	0	0	3
9	CYL562 Organic Synthesis	3	0	0	3
10	CYL563 Transition and Inner Transition Metal Chemistry	3	0	0	3
11	CYL564 Biochemistry II	3	0	0	3
12	CYL565 Chemical Dynamics and Surface Chemistry	3	0	0	3
13	CYL566 Physical Methods of Structure Determination of Organic	3	0	0	3
14	CYL601 Group Theory and Spectroscopy	3	0	0	3
15	CYL602 Pericyclic Reactions and Photochemistry	3	0	0	3
16	CYL603 Basic Organometallic Chemistry	3	0	0	3
17	CYL604 Biochemistry III	3	0	0	3
18	CYP501 Physical Chemistry Laboratory Course I	0	0	4	2
19	CYP502 Organic Chemistry Laboratory Course I	0	0	4	2
20	CYP503 Inorganic Chemistry Laboratory Course I	0	0	4	2
21	CYP504 Biochemistry Laboratory Course I	0	0	4	2
22	CYP561 Physical Chemistry Laboratory Course II	0	0	4	2
23	CYP562 Organic Chemistry Laboratory Course II	0	0	4	2
24	CYP563 Inorganic Chemistry Laboratory Course II	0	0	4	2
25	CYP564 Biochemistry Laboratory Course II	0	0	4	2

Programe Elecives (PE)

S.No.	COURSES	L	T	P	TOTAL
1	CYL665 Solid State Chemistry	3	0	0	3

2	CYL666 Chemistry of Macromolecules	3	0	0	3
3	CYL667 Selected Topics in Spectroscopy	3	0	0	3
4	CYL668 Statistical Mechanics and Molecular Simulation Methods	3	0	0	3
5	CYL669 Biophysical Chemistry I	3	0	0	3
6	CYL675 Chemistry of Heterocyclic Compounds and Natural	3	0	0	3
7	CYL676 Bio-organic and Medicinal Chemistry	3	0	0	3
8	CYL677 Supramolecular Chemistry	3	0	0	3
9	CYL678 Recent Trends in Organic Chemistry	3	0	0	3
10	CYL685 Applied Organometallic Chemistry	3	0	0	3
11	CYL686 Inorganic Polymers	3	0	0	3
12	CYL687 Bioinorganic Chemistry	3	0	0	3
13	CYL688 Physical Methods in Inorganic Chemistry	3	0	0	3
14	CYL695 Applied Biocatalysis	3	0	0	3
15	CYL696 Non-aqueous Enzymology	3	0	0	3
16	CYL697 Selected Topics in Biochemistry	3	0	0	3

M.Tech. in Molecular Engineering : Chemical Synthesis and Analysis

CATEGORY	**L**	**T**	**P**	**TOTAL**
CREDITS	41	13	6	60

Programme Core (PC)

S.No.	**COURSES**	**L**	**T**	**P**	**TOTAL**
1	CYL721 Design, Synthesis, and Characterization of Organic Molecules	3	0	0	3
2	CYP722 Laboratory on Design, Synthesis and Characterization of Organic Molecules	0	0	6	3
3	CYL725 Molecules to Materials	3	0	0	3
4	CYL727 Inorganic Synthesis and Analysis	3	0	0	3
5	CYP728 Inorganic Synthesis and Analysis Lab	0	0	4	2
6	CYL729 Materials Characterization: Diffraction,Microscopy, and Thermal Analysis	3	0	0	3
7	CYL695 Applied Biocatalysis	3	0	0	3
8	CYD799 Minor Project	0	0	6	3
9	CYD801 Major Project (Part I)	0	0	12	6
10	CYD803	0	0	8	4
11	CYD802 Major Project (Part II)	0	0	24	12
12	CYD804	0	0	28	14

Programme Electives (PE)

S.No.	COURSES	L	T	P	TOTAL
1	BML820 Biomaterials	3	0	0	3
2	BML830 Biosensor Technology	3	0	2	4
3	CHL634 Management of R&D in Chemical Industries	3	0	0	3
4	CHL705 Electrokinetic Transport in Chemical Engg.	3	0	2	4
5	CHL727 Heterogeneous Catalysis and Catalytic Proc	3	0	2	4
6	CHL731 Introduction to Soft Matter	3	0	0	3
7	CHL743 Petrochemical Technology	3	0	0	3
8	CHL766 Interfacial Engineering	3	0	0	3
9	CHL773 Planning of Experiments and Analysis of Engineering Data	3	0	2	4
10	CHL794 Petroleum Refinery Engineering	3	0	2	4
11	CHL807 Population Balance Modelling	3	0	0	3
12	CYL668* Statistical Mechanics and Molecular Simulations Methods	3	0	0	3
13	CYL677* Supramolecular Chemistry	3	0	0	3
14	CYL685* Applied Organometallic Chemistry	3	0	0	3
15	CYL686* Inorganic Polymers	3	0	0	3
16	CYL717 Principles of Chemical and Biosensors	3	0	0	3
17	CYL726 Cheminformaticsand Molecular Modelling	3	0	0	3
18	CYS801 Independent Study	0	4	0	4
19	MEL674 Principles of Management	3	0	0	3
20	PTL701 Polymer Chemistry	3	0	0	3
21	PTL705 Polymer Characterization	2	0	2	3
22	PTL711 Engineering Plastics and Speciality Polymers	3	0	0	3
23	TTL773 Design of Experiments and Statistical Techniques	3	0	0	3
24	CYL715 Bioanalytical Chemistry 3-0-0 3	3	0	0	3
25	SML802 Management of Intellectual Property Rights 3-0-0 3	3	0	0	3

Additional courses

S.No.	COURSES	L	T	P	TOTAL
1	CYL701 Electroanalytical Chemistry	3	0	4	5
2	CYL702 Chemical Separations	3	0	4	5
3	CYL703 Spectrochemical Methods	3	0	4	5
4	CYL704 Chemical Computations	2	0	2	3
5	CYL705 Environmental Analytical Chemistry	3	0	0	3
6	CYL707 Electronics and Chemical Instrumentation	3	0	0	3
7	CYL711 X-ray and Electron Microscopic Methods	3	0	0	3
8	CYL712 Characterization of Surfaces	3	0	0	3
9	CYL713 Characterization of Polymers	3	0	0	3
10	CYL714 NMR and Mass Spectrometric Methods	3	0	0	3
11	CYL715 Bioanalytical Chemistry	3	0	0	3

12	CYL716 Data Analysis, Experimental Design, andChemometrics	3	0	0	3
13	CYL717 Principles of Chemical and Biosensors	3	0	0	3
14	CYL718 On-line Methods of Chemical Analysis	3	0	0	3
15	CYL723 Principles and Practice of Optical and NMRSpectroscopy	3	0	0	3
16	CYL726 Cheminformatics and Molecular Modeling	3	0	0	3
17	CYL727 Inorganic Synthesis and Analysis	3	0	0	3
18	CYL731 Analytical Separations	3	0	0	3
19	CYL732 Electroanalytical Chemistry	3	0	0	3
20	CYL733 Chemistry of Industrial Catalysts	3	0	0	3
21	CYL734 Chemistry of Nanostructured Materials	3	0	0	3
22	CYT735 Industrial Training	0	0	4	8
23	CYS801 Independent Study	0	4	0	4
24	CYP803 Glass Blowing	0	0	2	1
25	CYC805 Seminar	0	2	0	2

List of Seminars (2013)

S.No.	Date	Name	Place	Title
1.	04/01/2013	Dr.Samit Guha	Department of Organic & Biomolecular Chemistry, University of Göttingen, Tammannstrasse 2, 37077 Göttingen, Germany	Design of Artificial Molecular and Ion Recognition Systems
2.	17/01/2013	Dr. D. L. V. K. Prasad	Baker Laboratory, Cornell University, Ithaca, NY 14853, USA	Electronic structure and dynamics of H/Li/N systems at high pressure
3.	18/01/2013	Dr.B.Chattopadhyay	Michigan State University, Department of Chemistry East Lansing, USA	Transition Metal-Catalyzed C-H Activation Reactions and Transannulation of 1,2,3-Triazoles
4.	18/01/2013	Dr.Rajarshi Samanta	Max-Planck Institute of Molecular Physiology, Dortmund, Germany	From C-H Functionalization to Radical Mediated Opening of Chiral Epoxy Alcohols
5.	08/02/2013	Dr.E.Balaraman	SRM Research Institute, SRM University, Chennai, Tamil Nadu	Sustainable Catalysis by Cooperative Ru(II) Complexes
6.	22/02/2013	Dr.Bani Kanta Sarma	Department of Chemistry, The Scripps Research Institute Florida	Rapid construction and high-throughput screening of novel combinatorial libraries to identify bioactive molecules
7.	08/03/2013	Dr.Prantik Maity	University of Delaware, Department of Chemistry & Biochemistry, 401 Academy Street, Newark, DE, 1971	Copper(I) Catalysis of Oxocarbenium Ions
8.	12/03/2013	Dr. Md. Ehesan Ali	LehrstuhlfuerTheoretischeChemie, Ruhr-Universitaet Bochum, 44780 Bochum, Germany	Organic and Metallo-organic Molecules in Magnetism to Molecular Spintronics: challenging aspects of DFT and a recent

				advancement
9.	22/03/2013	Dr. G. Saravanan Kanagawa	University, Japan	Intermetallic Pt3Ti nanoparticles for exhaust purification and fuel cell applications
10	22/03/2013	Dr.Subhash Banerjee	Department of Chemistry Guru GhasidasVishwavidyalaya (A Central University) Bilaspur, C.G.	Organic Chemistry
11	11/04/2013	Dr.Indu Bhusan Deb		Redox Neutral Reaction Cascades: a-Functionalization of Amines
12	12/04/2013	Dr.Shivajirao Lahu Gholap	Department of Chemistry, Yale University, USA	Stereoselective Synthesis of Diazofluorene Antitumor Antibiotics and Bioactive Styryllactones
13	15/04/2013	Dr.Sudhanshu Shukla	Radiation Oncology Branch, Center for Cancer Research, National Cancer Institute, National Institutes of Health, Bethesda, MD, 20892, USA	Biochemistry of Sirtuin 2 &Sirtuin 3: Targets to mitigate Radiation Induced Neurotoxicity?
14	17/04/2013	Dr.Ramendra Pratap	University of Delhi	Synthesis of functionalized Arenes and Heteroarenes through Ring Transformation Strategy
15	18/04/2013	Dr. G.Parthasarathy	Dept. of Organic Chemistry, Leibniz-University of Hannover, Germany	New strategies and methods for the total synthesis of natural products
16	22/04/2013	Dr. Asish Pal	Stratingh Institute of Chemistry, Nijenborgh 4, 9747 AG, Groningen, The Netherlands	Soft tunable materials in a bottom-up approach with specific molecular

				recognition
17				
18	13/05/2013	Dr. Prashant Sinha		Some interesting ion-induced effects in polyelectrolytes and charged colloids
19	17/06/2013	Dr. Kuntal Pal	Technical University of Kaiserslautern, Department of Chemistry, Building 54/665, Erwin Schrödinger road, 67663 Kaiserslautern, GERMANY	Chemistry of Molybdenum in Variety of Oxidation States: Combined Experimental and Computational Study
20	24/06/2013	Dr. Karthik Ramasamy	The University of Alabama	New Approaches to Metal Chalcogenide Thin Films and Nanocrystals
21	24/06/2013	Dr. M. Baidya	Molecular Catalyst Research Center, Chubu University, Japan	Rich Chemistry of Nitroso Compounds
22	05/072013	Dr. Amilan Jose		Supramolecular Receptors for Bioanalytes and Catalysis
23	09/07/2013	Dr. Soma Seth Duley		Conceptual Density Functional Theory Approach Towards Bonding, Aromaticity And Reactivity
24	18/07/2013	Dr. Ved Prakash Verma	Institute of Chemistry, Academia Sinica, Taipei, Taiwan	TMSOTf-Catalyzed Silylation of Carbohydrates, Regioselective One-Pot Protection and Acetylation and glycosylation reaction of 2-deoxy sugars
25	19/07/2013	Dr. Pravin P. Ingole	Central University of Rajasthan	Voltammetric Investigations on Semiconductor Nanomaterials for Energy Applications
26	23/07/2013	Dr. Nabanita Sadhukhan	Institute of multidisciplinary research for advanced materials,	Monodisperse PEG with Modified

			Tohoku University, Japan	Physicochemical and Biochemical Properties
27	26/072013	Dr. KrishnajiTadiparthi		Biocatalysis in Organic Synthesis
28	29/07/2013	Dr. Sambhu Bhadra	Steer Engineering Pvt. Ltd. Bangalore	Synthesis and application of a few specialty polymers
29	31/07/2013	Dr. E. S. Shibu	Health Research Institute, National Institute of Advanced Indusrtial Science and Technology (AIST), Takamatsu, Kagawa, Japan	Engineered Nanomaterials for Molecular Sensing and Bioimaging
30	2/08/2013	Dr. Hari Krishna Bisoyi	Liquid Crystal Institute, Kent State University, United States	Synthesis and characterization of liquid crystalline materials for display and non-display application
31	02/08/2013	Dr. P Sangeetha		Supported metal catalysts towards hydrogen economy
32	05/08//2013	Dr. M.Shanmugam	Northwestern University, Evanston-60202, IL-USA	Magnetic Characterization of Single Molecule Magnets (SMMs)
33	06/08/2013	Dr. Nambi Krishna		Development of ion-conducting polymer membranes for PEFCs: Synthesis, Characterization, Fabrication of MEAs and Fuel Cell Performances
34	07/08/2013	Dr. M.Kaliappan	Institute for Theoretical Physics, Goethe University, Frankfurt am Main, Germany	Nanofabrication using Electron Beam: Insights from Theoretical Modeling of EBID Precursors on a SiO2 Substrate
35	07/08/2013	Dr. V.R.Doddi	INSPIRE-Faculty, CSIR-Indian Institute of Chemical Technology, Hyderabad	Synthetic Iminosugars as Enzyme Inhibitors

36	08/08/2013	Dr. Ram Maurya		Continuous flow microreactor chemistry
37	08/08/2013	Dr. Susanta K. Nayak		Transition from Crystallization of Liquids to Liquid-Crystalline Materials Design
38	12/08/2013	Dr. Hari Prasad	Department of Medicinal Chemistry, University of Kansas, Multidisciplinary Research Building.	Design and synthesis of vaccine adjuvants and other biologically active small molecules
39	12/08/2013	Dr. Hemant Kashyap	Institute for Computational Molecular Science, Temple University, Philadelphia, PA-19122, USA, Former Address: Department of Chemistry, University of Iowa, Iowa City, IA-5242, USA	Multi-scale Computational Modeling of Soft Materials
40	12/08/2013	Dr. Ujjwal Mandal	Chemical Physics Lund University, Sweden	From Optical to X-Ray Spectroscopy: Study Dynamics and Structure
41	13/08/2013	Dr. Pramod B Shinde		Natural Product Drug Discovery through Biosynthetic Pathway Engineering
42	14/08/2013	Dr. Lokendra P. Singh	Department of Chemistry and Biochemistry, Arizona State University, Tempe, Arizona 85287, U.S.A.	Revealing Hydrogen-Bonded Structures in alcohols using linear & non-linear dielectric spectroscopy
43	16/08/2013	Dr. Mohammad Shahid	Department of Chemistry, Indian Institute of Technology Delhi.	Design, Synthesis and Applications of Fluorescent Probes for Detection of Ions
44	21/08/2013	Dr. KapilArya		Confinement of

				Ionic liquids in Carbon Nanotubes: Major advance in chironanotechnology
45	27/08/2013	Dr. Ravi Kumar K.		Fluorescent Molecular Nanoparticles and Molecular Engineering for Dye Sensitized Solar Cell Applications
46	29/08/2013	Dr. Satish Kumar	Department of Chemistry, St. Stephen's College, University Enclave, Delhi	Optically controlled sensing of metal ions
47	25/10/2013	Dr. Ravi P Barnwal	Department of Chemistry and Biochemistry, University of Washington, Seattle, USA	Insight into the architecture and function of mRNA processing assembly by NMR spectroscopy
48	22/11/2013	Dr.Yusuf Akhter	School of Life Sciences, Central University of Himachal Pradesh, Kangra, Himachal Pradesh	Fighting Drug-Resistance: Will it be possible to eradicate Tuberculosis?
49	06/12/2013	Dr. Kamlesh Kumar	Zernike Institute for Advanced Materials, University of Groningen, Netherlands	Polymer, Metal, Ceramic, Carbon, and Hybrid Microtubes by Strain-Driven Self-Rolling
50	16/12/2013	Dr. Sudeshna Ray	Department of Chemistry. AISECT University, Bhopal, India	Exploration of new phosphors using a "Mineral-inspired approach" and control of photoluminescence properties of phosphor by "Charge-compensated aliovalent element substitution"
51	03/012014	Dr. Zoheb Karim	Lulea University of Technology,	Use of immobilized

			Lulea, 97755, Sweden	enzymes and nanocellulose in pollutant bioremediation

Section 2

TEACHING ENVIRONMENT

2.1 Student-Teacher ratio separately and total for PG, PhD (based *on gross numbers a on class size basis)*

	II Sem 2010-11	**I Sem 2011-12**	**II Sem 2011-12**	**I Sem 2012-13**	**II Sem 2012-13**	**I Sem 2013-14**
No. of courses (UG, PG)	3, 13	2,15	2,15	5, 15	2, 15	3, 15
Average class size (UG, PG)	230.0, 39.2	198.0, 28.2	224.0, 31.0	139.0, 41.9	234.0, 33.2	190.6, 43.0

*The department does not run a separate UG programme. An integrated MS program at the UG level is a part of our vision.

The department runs one theory and one lab (CYL100 and CYP100) for all UG students (~870) admitted to the institute. In addition, the department also offers two Programme Linked Basic Science Courses to UG students in the chemical engineering and physics departments.

2.2 No. of students graduated in each programme, incl. Ph.D.

Degree Program	**2009**	**2010**	**2011**	**2012**	**2013**
M.Sc.	27	35	33	44	44
M.Tech	-	5	8	7	10
Ph.D.	18	13	15	19	9

2.3 Student-T.A. ratio

TAs supervise UG and PG labs, conduct/evaluate quizzes, exams and assist teachers in grading. For UG and PG courses, there is one TA for 25 students. TAs also assist coordinators of large classes with a number administrative matters and provide other logistical support. Many instrumental facilities in the department are exclusively run by PhD students with no technical staff associated with. TAs from major user-groups assist the faculty-in-charge in the operation and maintenance of these facilities.

2.4 No. of skilled technical staff

S. No.	Name	Designation	Location
1	Jai Prakash Singh	Tech. Supdt.	M.Tech. lab
2	Virander Kumar	Jr. Tech. Supdt	Glass Blowing (Central Facility)
3	Munnal Lal	Jr. Tech. Supdt	UG lab
4	Keshav Dev	Jr. Tech. Supdt	NMR operator (Department facility)
5	Prithvi Singh Rawat	Jr. Tech. Supdt	M.Sc.lab
6			
7	Jagdish Prasad	Jr. Tech. Supdt	Instruments Lab
8	Inder Pal	Jr. Tech. Supdt	UG lab
9	Rajvir Singh	Jr. Lab. Asstt.	M.Tech. Lab
10	Suresh Chander	Jr. Lab. Asstt.	UG lab
11	Ved Prakash	Jr. Lab. Asstt.	M.Sc. lab
12	Sunil	Jr. Lab. Asstt.	Glass Blowing (Central Facility)
13	Aalok Pratap Yadav	Jr. Tech. Supdt	NMR (Central facility)
14	Bhoopinder Singh	Jr. Tech. Supdt.	Instruments Lab
15	Narugopal Kuily	Jr. Tech. Supdt.	Instruments Lab

2.5 Gross laboratory space (in sq. ft.) for core UG/PG teaching

UG (~450 students per semester)	3529
PG: M.Sc. +M.Tech. labs (total ~120 students per semester)	1176 + 1953 = 3129

2.6 Laboratory modernization performed during 2009-2013 for (i) M. Sc. (ii)M.Tech. and (iii) elective courses

M.Sc.	Almost every year one or two new experiments are being introduced at every level. M.Sc. and M.Tech. students use various Instrument facilities in the department as part of core lab courses as well as one year research project during third and fourth semesters.
M.Tech	New M.Tech. program on 'Molecular Engineering'was initiated in July

	2008. The lab was also modernized for this purpose. This lab is also used for running M.Sc. Labs.

2.7 Course files for each course (2009-2013)

The course files for each of the courses are maintained by individual faculty members who have coordinated their respective courses. A few courses are also available on individual website.

2.8 Study materials (monographs, notes, books, videos, web-based materials, etc.) Prepared course-wise (2009-2013)

UG related

http://web.iitd.ac.in/~nkurur/courses.htm
http://web.iitd.ac.in/~njain/CYL120/cyl120.html
http://web.iitd.ac.in/~sdeep
http://web.iitd.ac.in/~sapra/course.html
http://web.iitd.ac.in/~elias/ProblemsinPblock.html
http://web.iitd.ac.in/~sapra/CYL110/
http://web.iitd.ac.in/~ashok/course.html
http://web.iitd.ac.in/~elias/ProblemsinPblock.html

PG related

http://web.iitd.ac.in/~elias/ProblemsinOM.html
http://web.iitd.ac.in/~aramanan/Assignments.html
http://web.iitd.ac.in/~pramitc/courses.html
http://web.iitd.ac.in/~sapra/CYL561/
http://web.iitd.ac.in/~ashok/course.html

Textbooks

(i)Basic Organometallic Chemistry: Concepts, syntheses and applications, B.D. Gupta and Anil. J. Elias CRC Press (Second Edition 2013**)**
(ii)A collection of Interesting General Chemistry Experiments, Anil J. Elias, Revised Edition (2008)
(iii) Crystal Engineering – A Textbook, G.R. Desiraju, J.J. Vittal and A. Ramanan, World Scientific (2011)

Books

(i)Lasers in Chemical and Biological Sciences (Second reprint 2012), Eds: H M Chawla and S. Chopra, New Age Publishers, New Delhi
(ii)Introduction to Molecular Engineering (2014), H M ChawlaAne Books and CRC Press, Germany

Monographs

Chaturvedi, S. and Khare, S. K. (2012) "Reducing Wastages in Processed Food Sector" A monograph for Ministry of Food Processing Industries, Govt. of India.

Book Chapters

(i)Karan, R., Kumar, S., Sinha, R. and Khare, S.K. (2012) Halophilic microorganisms as source of novel enzymes In: Microorganisms in Sustainable Agriculture and Biotechnology. Springer, Germany.

(ii)Sinha, R. and Khare, S.K. (2012) Thermostable proteases In: Thermophiles in Environmental and Industrial Biotechnology. Springer, Germany.

(iii)Chawla, H.M., Pant, N., Kumar, S., Kumar, N., and Black, D. (2012) Claixarene based materials for chemical sensors In: Chemical Sensors, Vol. 3, Ed. Korotcenkov, G., Momentum Press, New York.

(iv)Zoeni, A., Bandhyopadhyay S. and Chawla, H.M. (2014) Flyash propylene particulate composites, In: Developments in nano Composites Eds: Kar, K. and Hodzic, A., Research Publication Services, Singapore.

2.9 Research and Innovations in teaching-learning processes

Many faculties use modern technology to bring innovations in teaching-learning process at UG/PG level courses: Live demonstrations in the class, open book exams, videos etc.

Both M.Sc. and M.Tech. students carry out one year project with an objective to train them in research methodology. In recent years, a few good publications have come out of this venture.

2.10 No. of students (M.Tech. and Ph.D. separately) who have spent at least a semester at another university/institute (India/abroad)

Degree Program	Name	Institute/University	Duration
Ph.D.	Surender Karwasara(2009CYZ8532)	I.I.T. Bombay	Jan. – Feb., 2014
Ph.D.	Maninder Singh (2011CYZ8199)	EPFL, Lausanne	Aug. - Nov., 2013
Ph.D.	Goutam Mukherjee(2007CYZ8340)	Wesleyan University, Connecticut	May – June. 2012
Ph.D.	Tanya Singh (2008CYZ8260)	Norway	April - Sept., 2012
Ph.D.	Chinthalapalli Srinivas (2007CYZ8130)	EPFL, Lausanne	Sept. 2010 – Mar. 2011
Ph.D.	Mohammad Ashhar Iqbal Khan (2008CYZ8420)	Lund University, Sweden	Aug.12 to till date

M.Tech.	Tejshwini Pradhan (2012CYM2859)	TU Munchen, Germany	Sept.13 to till date
M.Tech.	Parul Goel (2010CYM3733)	RWTH Aachen University, Germany	Aug.11 to May,12
M. Tech.	Rupali Tripathi (2011CYM3469)	RWTH Aachen University, Germany	Sept. 2012 – Mar., 2013

2.11 No. of students from overseas/Indian universities who have taken classes, done Project work or internship UG &PG separately in the department

S. No.	Name	Institute/University	Duration
1	Ambre Fau	Exchange student, France	CYL729: Jan. – May 2014
2	Anjali Chopra	Jayoti Vidyapeeth Women's University (JVWU), Jaipur	Feb-June, 2013
3	Saloni Sharma	Inspire Fellow from Vishwa Bharati University, Shanti Niketana, WB	June – July, 2011
4	Arvind Pandey	Madurai Kamraj University, Madurai	May-July, 2010
5	Anuradha Sharma	Sardar Patel University, Anand, Gujarat	Jan - April, 2009

2.12 Course feedbacks

All UG and PG students provide feedback in the online academic system. Four of our faculty have been recognized as Best Teachers for I year teaching. Details are provided in Section 9.1.

2.13 Industry experts who have delivered lecture(s),seminars, discussions as part of a core/elective course.

Nil

2.14 Industry exposure to M. Sc./M. Tech./Ph. D. students

Three students are doing one year project work at R&D IOCL, Faridabad as part of M.Tech. programme with joint supervision. A few Ph.D. students are also working on joint projects with R&D labs (DRDO, SSPL, CEFEES) and industries (Daichi, Gurgaon).

S. No.	Industry	Programme Type	Date
1	BPCL, NOIDA	All M. Tech. students	October, 2013
2	IOCL, FARIDABAD	All M. Tech. students	12th January, 2013

Section 3

RESEARCH

3.1 No. of Masters and Ph.D. students supported - (i) by Institute Assistantship, (ii) on sponsored projects/consultancies, (iii) others sources and (iv) sponsored by external organizations

Degree	Financial support	2009	2010	2011	2012	2013
M.Tech.	Institute	-	-	7	13	17
Ph.D.	Institute Assistantship	8	9	10	10	6
	CSIR/UGC/DBT/ DST-Inspire/	10	23	25	15	8
	Project	1	1	1	1	3
	Part-time	1	1	1	2	4

3.2 No. of Ph.D.s enrolled, graduated for the last 5 years

Ph.D.s	2009	2010	2011	2012	2013
Enrolled	20	34	37	28	21
Graduated	18	13	15	19	9

3.3 Major Areas of research

Research Themes pursued in the Department

Synthesis

Natural product & asymmetric organic synthesis, Novel synthetic methodologies, organometallics, coordination chemistry, supramolecular chemistry, organic & inorganic materials (HMC, PSP, RNR, NGR, VH, NJ, RPS, AKS, AJE, RS, JDS, AKG, AR)

Theoretical and Computational Chemistry

Physics and chemistry of liquids, computational materials science, biomolecular simulations

(CC, BJ, SD, SS, HK)

Biochemistry: Chemistry at the Interface with Biology & Medicine

Applied enzymology, bioseparation, microbial biochemistry, Chemical biology, peptidomimetics, biological structure & function, drug discovery & medicinal chemistry,

small molecule recognition & probes, protein structure & dynamics, bioinorganic, metal-centered complexes, computational biology & modeling, biophysical processes and spectroscopy, biomolecular thermodynamics

(Experimental: MNG, SKK, VH, SD, DB, PKC Theory: BJ, CC, HK)

Innovative analytical measurements

Crystallographic techniques (X-ray and electron), microscopic techniques (optical, Raman, electron), NMR methodology, structural biology by NMR, mass spectrometry, spectroscopic techniques, microscopy and single molecule, Nanosecond spectroscopy, Electrochemical measurements

(AR, AKG, SP, NDK, NGR, SN, PKC, SS, SD, PI)

Nanostructured and Soft materials

Nanoscale chemistry, soft matter, colloidal systems, clusters, nanoscale assembly

(CC, HK, AKG, SS, SP, RS, AKS, PI)

Chemical dynamics, mechanism

Reaction dynamics, computation of reaction pathways, enzyme kinetics, aggregation kinetics

(SP, SKK, NGR, NP, SD, PKC, CC, MNG)

Catalysis

Organometallics, organo-catalysis, enzymes & biocatalysts, nanocatalysts, photocatalysis, heterogeneous catalysis & surface chemistry

(AKS, AJE, RS, AKG, NJ, SKK, MNG)

Functional Materials

Solid state synthesis, polymers and soft materials, magnetism & superconductivity, energy materials, optical & electronic properties

(AR, AKG, SS, RS, SP, PI)

Energy & environmental Chemistry

New energy materials, solid state batteries, photovoltaics, biofuels

(AKG, SS, SKK, AR, JDS, RS, MNG)

New areas of Research initiated in the past 5 years

Microbial chemistry (2009), Low-valent main group chemistry, carbine chemistry, Bio-organometallic chemistry (2009), Single molecule spectroscopy (2009), Nanocatalysis (2010), C-H activation, Asymmetric catalysis (2013), Simulation, electrochemistry (2013)

3.4 Publications and citations

Degree	2009	2010	2011	2012	2013
Faculty	24	24	24	24	26
Publications	63	90	98	117	112
Average Publication	2.2	3.7	4.0	4.9	4.0
Citations	908	849	521	375	75

3.5 Publications (Peer reviewed Journals) by PG and Ph.D. students

Majority of the publications (>95%) are jointly with Ph.D. students. Twenty plus M.Sc.and M.Tech. students are part of peer reviewed publications in the past five years.

3.6 Best papers in last 5 years

Refer Annexure I given below

3.7 Average citation per department/center

Refer Table given above

3.8 Changes, modifications, etc. done to improve the quality of (i) M.Tech. and (ii) Ph.D. graduates.

(a) Industrial visits for M.Tech. students - Two (one each to IOCL & BPCL)

(b) M. Tech. Lab modernized in 2011

(c) First in-house symposium organized in November 2013 where all senior Ph. D. students presented their research work in the form of oral/poster presentation. (http://www.chemistry.iitd.ac.in/NHCS/)

3.9 IRD projects individually and/or with others: Total : 20.1 crores

Type of Project	Amount (in crores)	Individual	With another faculty within the dept	With another faculty of another dept/center	With another faculty from different institute
Sponsored	11.7	40	4	1	0
Infrastructure related Projects	5.4		2		
Conference/Meetings etc	2.5	2			3
RA, Women scientist etc	0.5	9	-	-	-

3.10 Industry consultancies (2009-13) Total: Rs. 1.73 crores

- Biocatalyst Designs and Process Optimization for biotransformation
- Development of professes for isolation of nucleic acids, enzymes related to nucleic acids and kits related to above
- Development of Calix[4]Arene Crown Ether derivatives for use in Cesium separation from radioactive waste reg.
- Development of processes for purification of antibodies from biological fluids including fermentation broths & kits related to the above
- Solubilization of Proteases from Bacillus Licheniformis
- Immobilized Lipase for Fatty Acid Ethyl Ester (FAEE) Synthesis
- Selective and Sensitive detection of mercuric ION by Novel Dansyl-Appended Calix[4]arene molecules via fluorescence quenching
- Development of small molecules targeting cancer proteins
- Expert opinion with regard to novelty and inventiveness of invention described in 489/CHENP/2009
- Structural Proteomics of Plasmodium vivax Development of a Three-Dimensional Structural Dutubare of 500 soluble proteins in malaria paranite
- Development of innovative fertilizers – Regulating Nitrogen Delivery (RND)
- In-Vitro binding study of Bile Acid Salts to resin
- A method for preparation of cross-linked protein coated micro-crystal
- Transfer of Technologies on drug discovery and proteomics
- Investigation of the Enzyme Inactivation Properties of Test Comp**o**und (GlaxoSmithKline Consumer Healthcare R&D)

3.11 New areas of research which are different from the faculty's PhD thesis area

Almost all faculty is pursuing research in areas distinctly different from their Ph. D. work.

3.12 Methodology for (i) identifying obsolescence in research areas, and (ii) identification of new areas for future research

Students feedback during class committee meetings and online survey. Periodic discussion at DFB.

3.13 **Number of large interdisciplinary projects**

Infrastructure projects for strengthening research facility - 2

Department received two major equipments, ESI-Mass spectrometer and Confocal Microscope under DST-FIST Scheme (2009 – 2013)

In recognition of the Department's achievements in research, DST granted Rs. 2.5 crores during International year of Chemistry (2011). The department bought a 500 MHz NMR with a matching grant from IIT.

Annexure I

BEST THREE PAPERS IN THE LAST FIVE YEARS (2009-2013)

Prof. D. Bandyopadhyay

1. Singh, A.; Agarwala, A.; Kamaraj, K.; Bandyopadhyay, D. The mechanistic aspects of iron(III) porphyrin catalyzed oxidation reactions in mixed solvents. *Inorganica Chimica Acta* 2011, *372*(1), 295-303.
2. Biswas, A. N.; Das, P.; Agarwala, A.; Bandyopadhyay, D.; Bandyopadhyay, P. Selective hydroxylation of alkanes catalyzed by iron(IV)corrole. *Journal of Molecular Catalysis A: Chemical* 2010, *326*, 94-98.
3. Bagchi, V.; Bandyopadhyay, D. In situ generation of palladium oxide nanocrystals. *Journal of Organometallic Chemistry* 2009, *694*(9-10), 1259-1262.

Prof. C. Chakravarty

1. Bozorgui, B.; Meng, D.; Kumar, S.K.; Chakravarty, C.; Cacciuto, A. Fluctuation-driven anisotropic assembly in nanoscale systems. *Nano Letters* 2013, *13*(6), 2732-2737.
2. Nayar, D.; Agarwal, M.; Chakravarty, C. Comparison of Tetrahedral Order, Liquid State Anomalies, and Hydration Behavior of mTIP3P and TIP4P Water Models. *Journal of Chemical Theory and Computation* 2011, *7*(10), 3354-3367.
3. Agarwal, M.; Singh, M.; Sharma, R.; Alam, M. P.; Chakravarty, C. Relationship between Structure, Entropy, and Diffusivity in Water and Water-Like Liquids. *Journal of Physical Chemistry B* 2010, *114*(20), 6995-7001.

Prof. H. M. Chawla

1. Chawla, H. M.; Goel, P.; Shukla, R. New calix[4]arene based oxalylamido receptors for recognition of copper(II). *Tetrahedron Letters* 2013, *54*(22), 2766-2769.
2. Chawla, H. M.; Shukla, R.; Pandey, S. Preferential recognition of zinc ions through a new anthraquinonoidal calix[4]arene. *Tetrahedron Letters* 2012, *53*(24), 2996-2999.
3. Pandey, S.; Azam, A.; Pandey, S.; Chawla, H. M. Novel dansyl-appended calix[4]arene frameworks: Fluorescence properties and mercury sensing. *Organic and Biomolecular Chemistry* 2009, *7*, 269-279.

Dr. Pramit Chowdhury

1. Singh, P.; Chowdhury, P. K. Crowding-induced quenching of intrinsic tryptophans of serum albumins: A residue-level investigation of different conformations. *Journal of Physical Chemistry Letters* 2013, *4*(16), 2610-2617.

2. Malik, A.; Kundu, J.; Mukherjee, S. K.; Chowdhury, P. K. Myoglobin unfolding in crowding and confinement. *Journal of Physical Chemistry B* 2012, *116*(43), 12895-12904.
3. Sharma, S.; Pal, N.; Chowdhury, P. K.; Sen, S.; Ganguli, A. K. Understanding Growth Kinetics of Nanorods in Microemulsion: A Combined Fluorescence Correlation Spectroscopy, Dynamic Light Scattering, and Electron Microscopy Study. *Journal of the American Chemical Society* 2012, *134*(48), 19677-19684.

Dr. Shashank Deep

1. Celik, Emrah; Faridi, Mohd. Hafeez; Kumar, Vinay; Deep, Shashank; Moy, Vincent T.; Gupta, Vineet Agonist Leukadherin-1 Increases CD11b/CD18-Dependent Adhesion Via Membrane Tethers. *Biophysical Journal* 2013, *105*(11), 2517-2527.
2. Srivastava, Abhishek; Meena, Shiv Kumar; Alam, Mashkoor; Nayeem, Shahid M.; Deep, Shashank; Sau, Apurba Kumar Structural and functional insights into the regulation of Helicobacter pylori arginase activity by an evolutionary nonconserved motif. *Biochemistry* 2013, *52*(3), 508-519.
3. Rani, Anjana; Pandita, Esha; Rahman, Safikur; Deep, Shashank; Sau, Apurba Kumar Insight into temperature dependence of GTPase activity in human guanylate binding protein-1. *PLoS One* 2012, *7*(7), e40487.

Prof. A. J. Elias

1. Keshav, K.; Kumar, D.; Elias, A. J. Synthesis, spectral, and structural studies of porphyrins having sterically hindered [η(5)-CpCo(η(4)-C_4Ph_4)] cobalt sandwich units at the meso positions. *Inorganic chemistry* 2013, *52*(21), 12351-66.
2. Singh, N.; Elias, A. J. Cyclopentadienyl 1,2- and 1,3-Disubstituted Cobalt Sandwich Compounds {η^5-$[MeOC(O)]_2C_5H_3$} Co(η^4-C_4Ph_4): Precursors for Sterically Hindered Bidentate Chiral and Achiral Ligands. *Organometallics* 2012, *31*(5), 2059-2065.
3. Singh, N.; Elias, A. J. Palladacycles of novel bisoxazoline chelating ligands based on the dimeric cyclobutadiene linked cobalt sandwich compound $[(\eta^5\text{-Cp})Co(\eta^4\text{-}C_4Ph_3)]_2$. *Dalton Transactions* 2011, *40*(18), 4882-4891.

Prof. A. K. Ganguli

1. Ganguli, A. K.; Prakash, J.; Thakur, G. S. The iron-age of superconductivity: structural correlations and commonalities among the various families having -Fe-Pn- slabs (Pn = P, As and Sb). *Chemical Society Reviews* 2013, *42*(2), 569-598.
2. Khanchandani, S.; Kundu, S.; Patra, A.; Ganguli, A. K. Band Gap Tuning of ZnO/In_2S_3 Core/Shell Nanorod Arrays for Enhanced Visible-Light-Driven Photocatalysis. *Journal of Physical Chemistry C* 2013, *117*(11), 5558-5567.

3. Sharma, S.; Garg, N.; Ramanujachary, K. V.; Lofland, S. E.; Ganguli, A. K. Design of Anisotropic Co3O4 Nanostructures: Control of Particle Size, Assembly, and Aspect Ratio. *Crystal Growth & Design* 2012, *12*(8), 4202-4210.

Dr. V. Haridas

1. Haridas, V.; Sadanandan, S.; Gopalakrishna, M. V. S.; Bijesh, M. B.; Verma, Ram. P.; Chinthalapalli, S.; Shandilya, A. Bispidine as a helix inducing scaffold: examples of helically folded linear peptides. *Chemical Communications* 2013, *49*(93), 10980-10982.
2. Haridas, V.; Sahu, S.; Sapala, A. R. Hierarchical organization from self-assembling disulfide macrocycles. *Chemical Communications* 2012, *48*(32), 3821-3823.
3. Haridas, V. From Peptides to Non-Peptide Alpha-Helix Inducers and Mimetics. *European Journal of Organic Chemistry* 2009, *30*, 5112-5128.

Dr. Nidhi Jain

1. Premi, C.; Jain, N. Phosphane-Free Hiyama Cross-Coupling of Aryl and Heteroaryl Halides Catalyzed by Palladium Nanoparticles in Ionic Liquids. *European Journal of Organic Chemistry* 2013, *2013*(24), 5493-5499.
2. Deshmukh, M. S.; Das, B.; Jain, N. Dual SNAr reaction in activated ortho-halonitrobenzene: Direct synthesis of substituted 1,2,3,4-tetrahydroquinoxalines, 2,3-dihydro-1,4- benzoxazines, and 1,4-benzodioxines. *RSC Advances* 2013, *3*, 22389-22395.
3. Srivastava, A.; Jain, N. Ethylacetoacetate tagged basic imidazolium salt: multi-task in CuI nanoparticle catalyzed amination of aryl halides. *Tetrahedron* 2013, *69*(25), 5092-5097.

Prof. B. Jayaram

1. Khandelwal, G.; Jayaram, B. DNA-water interactions distinguish messenger RNA genes from transfer RNA genes. *Journal of the American Chemical Society* 2012, *134*(21), 8814-8816.
2. Mittal, A.; Jayaram, B. Backbones of folded proteins reveal novel invariant amino acid neighborhoods. *Journal of Biomolecular Structure and Dynamics* 2011, *28*, 443-454.
3. Lavery, R.; Zakrzewska, K.; Beveridge, D.; Bishop, T. C.; Case, D. A.; Cheatham III, T.; Dixit, S.; Jayaram, B.; Lankas, F.; Laughton, C.; Maddocks, J. H.; Michon, A.; Osman, R.; Orozco, M.; Perez, A.; Singh, T.; Spackova, N.; Sponer, J. A systematic molecular dynamics study of nearest-neighbor effects on base pair and base pair step conformations and fluctuations in B-DNA. *Nucleic Acids Research* 2009, *38*, 299-313.

Prof. S. K. Khare

1. Sinha, R.; Khare, S. K. Characterization of detergent compatible protease of a halophilic Bacillus sp. EMB9: Differential role of metal ions in stability and activity. *Bioresource Technology* 2013, *145*, 357-361.
2. Kumar, S.; Khare, S. K. Purification and characterization of maltooligosaccharide-forming α-amylase from moderately halophilic Marinobacter sp. EMB8. *Bioresource Technology* 2012, *116*, 247-251.
3. Arvind Sinha, Vidya Nand Singh ;S.K. Khare (2011) Synthesis and characterization of monodispersed orthorhombic manganese oxide nanoparticles produced by Bacillus sp. cells simultaneous to its bioremediation. J. Hazard. Mater. 192: 620–627

Prof. N. D. Kurur

1. Singh, M.; Srinivas, C.; Deb, M.; Kurur, N. D. Paramagnetic Relaxation of Long-Lived Coherences in Solution NMR. *ChemPhysChem* 2013, *14*(17), 3977-3981.
2. Mithu, V. S.; Paul, S.; Kurur, N. D.; Madhu, P. K. Heteronuclear dipolar decoupling in solid-state nuclear magnetic resonance under ultra-high magic-angle spinning. *Journal of Magnetic Resonance* 2011, *209*, 359-363.
3. Augustine, C.; Kurur, N. D Heteronuclear dipolar decoupling in liquid-crystal NMR using supercycled SW(f)-TPPM sequences. *Magnetic resonance in chemistry: MRC* 2010, *48*(10), 798-803.

Dr. S. Nagendran

1. Siwatch, R. Kumar; Yadav, D.; Mukherjee, G.; Rajaraman, G.; Nagendran, S. Digermylene Oxide Complexes: Facile Synthesis and Reactivity. *Inorganic Chemistry* 2013, *52*(23), 13384-13391.
2. Karwasara, S.; Sharma, M. K.; Tripathi, R.; Nagendran, S. Synthesis and Reactivity of N-Aminotroponiminatogermylenepyrrole and Its Derivatives. *Organometallics* 2013, *32*(14), 3830-3836.
3. Sinhababu, S.; Siwatch, R. K.; Mukherjee, G.; Rajaraman, G.; Nagendran, S. Aminotroponiminatogermaacid Halides with a Ge(E)X Moiety (E = S, Se; X = F, Cl). *Inorganic Chemistry* 2012, *51*(17), 9240-9248.

Prof. P. S. Pandey

1. Tripathi, A.; Kumar, A.; Pandey, P. S. Visual chiral recognition of mandelic acid and α-amino acid derivatives by enantioselective gel formation and precipitation. *Tetrahedron Letters* 2012, *53*(43), 5745-5748.

2. Chhatra, R. K.; Kumar, A.; Pandey, P. S. Synthesis of a Bile Acid-Based Click-Macrocycle and Its Application in Selective Recognition of Chloride Ion. *Journal of Organic Chemistry* 2011, *76*(21), 9086-9089.
3. Kumar, A.; Chhatra, R. K.; Pandey, P. S. Synthesis of Click Bile Acid Polymers and Their Application in Stabilization of Silver Nanoparticles Showing Iodide Sensing Property. *Organic Letters* 2010, *12*(1), 24-27.

Prof. S. Pandey

1. Trivedi, S.; Pandey, S. Fluorescence Quenching of Polycyclic Aromatic Hydrocarbons by Nitromethane within Ionic Liquid Added Aqueous Anionic Micellar Solution. *Journal of Physical Chemistry C* 2013, *117*(4), 1818-1826.
2. Rai, R.; Pandey, S.; Baker, S. N.; Vora, S.; Behera, K.; Baker, G. A.; Pandey, S. Ethanol-Assisted, Few Nanometer Water-In-Ionic Liquid Reverse Micelle Formation by a Zwitterionic Surfactant. *Chemistry - A European Journal* 2012, *18*(39), 12213-12217.
3. Kumar, V.; Baker, G. A.; Pandey, S. Ionic liquid-controlled J- versus H-aggregation of cyanine dyes. *Chemical Communications* 2011, *47*(16), 4730-4732.

Prof. N. Pant

1. Chawla, H. M.; Santra, A.; Pant, N.; Kumar, S.; Kumar, N.; Black, D. S. Evaluation of deep cavity imidazolylcalix[n]arenes for selective extraction of silver. *Journal of Inclusion Phenomena and Macrocyclic Chemistry* 2012, *73*(1-4), 55-65.
2. Chawla, H. M.; Pant, N.; Kumar, S.; Mrig, S.; Srivastava, B.; Kumar, N.; Black, D. St. C. Synthesis and evaluation of novel tetrapropoxycalix[4]arene enones and cinnamates for protection from ultraviolet radiation. *Journal of Photochemistry and Photobiology, B: Biology* 2011, *105*(1), 25-33.
3. Chawla, H. M; Pant, N.; Kumar, S.; Singh, S. P. Synthesis and characterization of asymmetrically bridged calix[4]arene and tetrathiacalix[4]arene mono amido crown derivatives. *Journal of Chemical Research* 2010, *34*(7), 375-378.

Prof. R. N. Ram

1. Ram, R. N; Soni, V. K. Synthesis of 3-Alkylbenzoxazolones from N-Alkyl-N-arylhydroxylamines by Contiguous O-Trichloroacetylation, Trichloroacetoxy ortho-Shift, and Cyclization Sequence. *The Journal of organic chemistry* 2013, *78*(23), 11935-47.
2. Ram, R. N.; Soni, V. K.; Gupta, D. K. Organocatalytic selective benzoylation of alcohols with trichloromethyl phenyl ketone: inverse selectivity in benzoylation of alcohols containing phenol or aromatic amine functionality. *Tetrahedron* 2012, *68*(44), 9068-9075.

3. Ram, R. N.; Kumar, N.; Singh, N. Synthesis of Chlorinated Bicyclic C-Fused Tetrahydrofuro[3,2-c]azetidin-2-ones. *Journal of Organic Chemistry* 2010, *75*(21), 7408-7411.

Prof. A. Ramanan

1. Goswami, P. K.; Singh, M.; Thaimattam, R.; Ramanan, A. Extending the supramolecular synthon concept in flexible polyaminocarboxylate based coordination polymers. *CrystEngComm* 2013, *15*(45), 9787-9797.
2. Goswami, P. K.; Thaimattam, R.; Ramanan, A. Multiple Crystal Forms of p-Aminosalicylic Acid: Salts, Salt Co-Crystal Hydrate, Co-Crystals, and Co-Crystal Polymorphs. *Crystal Growth & Design* 2013, *13*(1), 360-366.
3. Singh, M.; Ramanan, A. Crystal Engineering of Polyoxomolybdates Based Metal-Organic Solids: The Case of Chromium Molybdate Cluster Based Metal Complexes and Coordination Polymers. *Crystal Growth & Design* 2011, *11*(8), 3381-3394.

Prof. N. G. Ramesh

1. Ramesh, N. G. Applications of 2-C-Formyl-Glycals in Organic Synthesis. *European Journal of Organic Chemistry* 2013 (in press).
2. Ganesan, M.; Salunke, R. V.; Singh, N.; Ramesh, N. G. Protecting group directed diversity during Mitsunobu cyclization of a carbohydrate derived diamino triol. Synthesis of novel bridged bicyclic and six-membered imino-cyclitols. *Organic & Biomolecular Chemistry* 2013, *11*(4), 599-611.
3. Martínez-Montero, S.; Fernández, S.; Sanghvi, Y. S.; Chattopadhyaya, J.; Ganesan, M.; Ramesh, N. G.; Gotor, V.; Ferrero, M. Design and divergent synthesis of aza nucleosides from a chiral imino sugar. *Journal of Organic Chemistry* 2012, *76*, 4671-4678.

Dr. Sameer Sapra

1. Soni, U.; Pal, A.; Singh, S.; Mittal, M.; Yadav, S.; Elangovan, R.; Sapra, S. Simultaneous Type-I/Type-II Emission from CdSe/CdS/ZnSe Nano-Heterostructures. *ACS Nano* 2013 (In press).
2. Sharma, A.; Pandey, C. M.; Matharu, Z.; Soni, U.; Sapra, S.; Sumana, G.; Pandey, M. K.; Chatterjee, T.; Malhotra, B. D. Nanopatterned cadmium selenide langmuir-blodgett platform for leukemia Detection. *Analytical Chemistry* 2012, *84*, 3082-3089.
3. Soni, U.; Sapra, S. The Importance of Surface in Core-Shell Semiconductor Nanocrystals. *Journal of Physical Chemistry C* 2010, *114*(51), 22514-22518.

Prof. Ravi Shankar

1. Shankar, R.; Asija, M.; Singla, N.; Basu, S.; Kociok-Koehn, G.; Molloy, K. C. Synthesis, characterization and selective de-esterification of diorganotinbis(O-methylphosphite)s. *Dalton Transactions* 2013, *42*(44), 15591-15598.
2. Khandelwal, D.; Hooda, S.; Brar, A. S.; Shankar, R. Poly(isobornyl methacrylate-co-methyl acrylate): Synthesis and stereosequence distribution analysis by NMR spectroscopy. *Journal of Polymer Science, Part A: Polymer Chemistry* 2012, *50*(16), 3350-3362.
3. Shankar, R.; Sahoo, U.; Shahi, V. Synthesis and Characterization of Fluorescent Polymer-Metal Nanocomposites Comprising Poly(silylene-co-silyne)s and Silver Nanoparticles. *Macromolecules* 2011, *44*(9), 3240-3249.

Prof. A. K. Singh

1. Joshi, H.; Sharma, K. N.; Sharma, A. K.; Prakash, O.; Singh, A. K. Graphene oxide grafted with Pd17Se15 nano-particles generated from a single source precursor as a recyclable and efficient catalyst for C-O coupling in O-arylation at room temperature. *Chemical Communications* 2013, *49*(68), 7483-7485.
2. Saleem, F.; Rao, G. K.; Singh, P.; Singh, A. K. Chalcogen-dependent palladation at the benzyl carbon of 2,3-bis[(phenylchalcogeno)methyl]quinoxaline: palladium complexes catalyzing Suzuki-Miyaura coupling via palladium-chalcogen nanoparticles. *Organometallics* 2013, *32*(2), 387-395.
3. Rao, G. K.; Kumar, A.; Ahmed, J.; Singh, A. K. Palladacycle containing nitrogen and selenium: highly active pre-catalyst for the Suzuki-Miyaura coupling reaction and unprecedented conversion into nano-sized $Pd_{17}Se_{15}$. *Chemical Communications* 2010, *46*(32), 5954-5956.

Prof. J. D. Singh

Kumar, A.; Singh, J. D. An Organoselenium-Based Highly Sensitive and Selective Fluorescent "Turn-On" Probe for the Hg^{2+} Ion. *Inorganic Chemistry* 2012, *51*(2), 772-774.

Section 4

INNOVATION, DESIGN AND DEVELOPMENT

4. Innovation, Design and Development

4.1 No. of students who have been funded for innovation (TePP, PRISM, etc.) Nil

4.2 Technology developed 1

4.3 Technology transferred 1

4.4 Number of patents granted and filed

S.No.	Title	PI	Appln. No.	Date of filing
1	Selective and sensitive detection of mercuric ION by Novel Dansy1-Appended Calix {4} arene molecules via fluroscence quenching	SP, HMC	Filed through Intellectual Ventures	23-Jun-09
2	A convenient methodology for the synthesis of nano-rods of LanthaniumHexaboride(LaB6)	AKG	377/Del/2011	14-Feb-11
3	Beta sheet inducer (P)	VH	2784/Del/2011	23-Sep-11
4	Alpha helix inducer (P)	VH	2785/Del/2011	23-Sep-11
5	Japanese encephalitis inhibitor (P)	VH	2786/Del/2011	23-Sep-11
6	Reverse turn inducer (P)	VH	2787/Del/2011	23-Sep-11
7	Process for purification of MBP or MBP tagged proteins	MNG	483/DEL/2012	21-Feb-12
8	Microbial process for removal of toxic phorbolesters from de-oiled Jatropha Seed cake	SKK	1845/Del/2012	15-Jun-12
9	Process for Purification of MBP or MBP tagged proteins	MNG	PCT/IN2013/0000092	13-Feb-13
10	Purification and assay for topoisomerases and use of the assay for screening modulators of topoisomerases	MNG	Provisional Patent Filed	
11	Methods and kits for tuning permeabilization of cells by three phase partitioning	MNG	Provisional Patent Filed	
12	A stereoselective enzyme alcohol dehydrogenase converting glycerol to D-glyceraldehyde: extraction, purification and characterization	MNG	Provisional Patent Filed	
13	Purification of supercoiled plasmid DNA	MNG	Provisional Patent Filed	
14	Enzyme catalyzed kinetic resolution of racemic pregabalin	MNG	Provisional Patent Filed	
15	Protein folding in vivo for overexpressed proteins in *Escherichia coli*	MNG	Provisional Patent Filed	

16	A method for preparation of a sensor material for detection, discrimination and estimation of amines	HMC	P.No.219870/710/DEL/1999	13-May-2008
17	A process for development of protective coating	HMC	P.No.230547/709/DEL/1999	11-May-1999
18	An improved process for production of aleuritic acid from lac and its waste, and product thereof (transferred to M/s Encee Aromatics Pvt. Ltd., Bangalore)	HMC	P.No.231078/701/DEL/1999	10-May-2000
19	A process for preparation of a coating component for coating fruits, vegetables, plants and hair	HMC	P.No.230929/702/DEL/1999	10-May-2000
20	Improved herbal skin care composition for acne derived through supramolecular interactions (As Inventor on Patents filed by Ozone)	HMC	Ref. File No. : OSCAR/IP/001	
21	Improved skin nourishment of natural products through supramolecular interactions (Applicant **:** Organized Skin Care and Research Institute Ltd.)	HMC	Our Ref. File No. : OSCAR/IP/003	
22	Novel herbal composition for enhancement of skin tonicity through supramolecular interactions (Applicant : Organized Skin Care and Research Institute Ltd.)	HMC	Our Ref. File No. : OSCAR/IP/004	
23	Enhanced efficacy of anti-wrinkle herbal compositions through supramolecular interactions (Applicant **:** Organized Skin Care and Research Institute Ltd.)	HMC	Our Ref. File No. : OSCAR/IP/005	
24	Breast carcinoma is the second most common cancer among women globally. In order to develop novel anti-breast cancer	BJ	No. 3126/DEL/2012 jointly by Amity & IITD.	

	compounds, SCFBio, IITD has designed some active biphenyl molecules whose cell line studies have been conducted. The compounds were found to be potent with micro-molar binding and a few of these have been patented under Indian act with the application			
25	Core shell PDMS-MOF microspheres as stationary phase for GC based separation	AR	No. 2766/DEL/2013 jointly with CFEES, DRDO	

4.5 Innovations of products processes, designs, etc. in the department

As chemists, new molecules, materials and processes are being continuously innovated. The students and faculty are also involved in designing and customizing a few equipments/facilities wherever required. Designing of glasswares for specific chemical reactions are routine feature. A custom built confocal microscope, spin coater, sputter-cum-vapor deposition units are a few to name.

4.6 Availability and access to students' workshops, "tinkering laboratories" so that they may pursue their own ideas

Our research laboratories provide ample space, time and freedom to encourage our students to think and carry out research independently. We also welcome them to develop new ideas.

4.7 No. of students who were recognized in national/international events

S. No.	Name of the student	Event/Award	Outcome
1	Abhilash Jayaraj	National: CODE for India	Third prize
2	Priyanka Dhingra	International: Critical Assessment of Structure Prediction(CASP-10)	Placed 13 out of 170 in 2012
3	Garima Khandelwal	Eli Lily outstanding thesis award 2013	Best thesis
4	Shruti Trivedi	IOCL award 2012	Best Ph.D. thesis in Chemistry, IITD
5	Parul		Best M.Tech. thesis in Chemistry, IITD
6	Pramod Kumar Goswami	IUMRS, Singapore	Best poster prize

7	Maninder Singh	20th NMR Society Meeting, Tezpur, Feb. 2014	Best Poster

Section 5

R & D ENVIRONMENT

5. R&D Environment

5.1 No. of post-doctoral scholars/RAs/hired (2009-2013)

S.No	Name of post doc	Supervisor	Project	Current Placement
Post-doctoral scholars/RAs hired in individual research projects				
1	Dr. Masood Nath	AKG	DST/CSIR	Muscat College,Oman
2	Dr. Mrinmoyee	AKG	DRDO	NTU, Taiwan
3	Dr. Aparna Ganguly	AKG	IITD	Nanoscale Research Facility, IITD
4	Dr P. Sharmila	AKG	DBT –Biocare	Chemistry, IIT Delhi
5	Dr. R. Parthasarathy	AKG	DST	IIT Delhi
6	Dr.OruganiAnjaneyulu	AKG	DST	IIT Delhi
7	Dr. Debashree Das	AKG	DeitY	IIT Delhi
8	Dr. Sonalika Vaidya	AKG	CSIR	Hindu College
9	Dr. Umesh Kumar	AKS	DST	IITD
10	Poornima Singh	AKS	DST	
11	Dr.Shruti Trivedi	SP	CSIR	IITD
12	Dr.Jaspreet Kaur	PSP	CSIR	
13	Dr.Neelam Huzoor Zaidi	SS	CSIR	
14	Dr.Satish Kumar	HMC	CSIR	St. Stephens college, Delhi University
15	Dr.Arun Kumar	AKS	CSIR	IITD
16	Dr.Unnati Ahluwalia	SD	IRD	Sri Venkateswara college, Delhi UNiversity
17	Dr.Roli Mishra	PSP	NASI/CSIR	IITD
18	Dr.Md.Shahid	HMC	IRD	IITD
19	Dr. G.K. Rao	AKS	CSIR	IITD
Research Associates with their own funding				
19	Dr. AshimaSah	AKG	*Women Scientist's* Program	IIT Delhi
20	Shubha Pandey	PSP	DST Fast track May 2013 – April 2016	Will shortly join DST as Scientist
21	Vedavati Singh	AKS	DST – Women Scientist	IITD
22	Dr. Monisha Barua	PSP	DST – Women	

			Scientist	
23	Dr. Puspanjali Tripathi	SS	DST Women Scientist	
24	Dr. Monika Agarwal	AR	DST Women scientist	Scientist, Patent Office, CSIR

No. of staffs employed in research projects/consultancy projects

EMP.CODE	JOINING	LIKELY/LEAVING DATE	NAMES	PROJECT NUMBER	CURRENT POSITION
8237	01-apr-2009	31-mar-2010	NEELAM HAZOOR ZAIDI	MI00634	Research Associate
8258	15-jun-2009	18-sep-2013	PRIYANKA DHINGRA	RP02146	Project Associate
8274	13-jul-2009	12-jul-2010	MAHENDRA VIKRAM SINGH RAJAWAT	RP01842	Junior Research Fellow
8360	23-sep-2009	22-mar-2013	VED VATI SINGH	RP02269	Project Scientist
10175	23-may-2013	22-may-2016	VED VATI SINGH	RP02744	Project Scientist
8367	11-sep-2009	21-jul-2011	AVINASH KUMAR MISHRA	RP02121	Junior Research Fellow
8369	16-sep-2009	30-jun-2010	BHARAT GADAKH	RP02160	Assistantship
8388	11-sep-2009	27-apr-2011	PALLAVI MOHANTY	RP02121	Junior Research Fellow
8467	02-dec-2009	01-jun-2010	ABIR BARAN MAJUNDER	RP01842	Project Scientist
8649	03-may-2010	31-jan-2011	UNNATI AHLUWALIA	MI00733	Assistantship
8810	05-oct-2010	04-oct-2013	SARALA NAIK	RP02402	Project Scientist
8976	28-jan-2011	30-jan-2014	ASHUTOSH SHANDILYA	MI00331	Project Associate
9278	05-oct-2011	18-sep-2013	ANJALI SONI	RP02146	Project Associate
9438	23-dec-2011	27-sep-2014	VANDANA	MI00331	Project Scientist
9439	28-dec-2011	18-sep-2013	SANJEEV KUMAR	RP02146	Junior Project Attendant
9440	28-dec-	18-sep-2013	SHASHANK	RP02146	Sr. Project

	2011		SHEKHAR		Scientist
9442	28-dec-2011	18-sep-2013	PREETI BISHT	RP02146	Sr. Project Assistant (Tech)
9527	23-feb-2012	22-feb-2013	SATYANARAYAN RAO	RP02146	Junior Research Fellow
9530	23-feb-2012	18-sep-2013	R NAGARAJAN	RP02146	Project Officer
9708	11-jul-2012	10-jul-2015	ASHIMA SAH	RP02643	Project Scientist
9724	19-jul-2012	18-jul-2015	UMESH KUMAR	RP02644	Project Scientist
9737	27-nov-2012	19-mar-2014	MANU SHARMA	RP02551	Research Associate
9754	01-aug-2012	30-jul-2014	RAJESH KUMAR	RP01924	Project Attendant
9755	01-aug-2012	30-jul-2014	DHARAMVEER	RP01924	Junior Project Attendant
9773	01-aug-2012	30-jul-2014	TARUN KUMAR	MI00603	Plant Operator
9779	01-aug-2012	28-jul-2014	SEEMA ARORA	RP01924	Sr. Project Assistant (Admn)
9780	01-aug-2012	28-jun-2014	SURINDER KUMARI	RP01924	Sr. Project Assistant (Admn)
9781	01-aug-2012	31-jul-2014	CHANDER MOHAN	RP01924	Jr. Project Assistant
9782	01-aug-2012	18-jul-2014	SNIGDHA REHALIA	RP01924	Jr. Project Assistant
9814	05-jul-2012	04-jan-2013	NEM SINGH	RP02446	Senior Research Fellow
9974	01-oct-2012	27-mar-2013	NIBEDITA DAS	RP02283	Senior Research Fellow
9978	29-aug-2012	28-aug-2015	ROLI MISHRA	MI01008	Research Associate
9990	01-feb-2013	31-mar-2013	ORUGANTI ANJANEYULU	RP02337	Senior Research Fellow
10162	11-apr-2013	10-oct-2013	DR. MOHAMMAD SHAHID	RP01924	Project Associate
10389	22-oct-	21-oct-2016	MOHAMMAD	RP02827	Project

	2013		SHAHID		Scientist
10400	11-oct-2013	21-oct-2013	MOHAMMAD SHAHID	MI01082	Assistantship
10171	11-apr-2013	10-oct-2013	NITIN KUMAR	RP01924	Project Assistant
10178	03-jun-2013	02-jun-2016	PUSPANJALI TRIPATHY	RP02748	Project Scientist
10179	24-may-2013	23-apr-2016	SHUBHA PANDEY	RP02746	Project Scientist
10231	15-apr-2013	14-oct-2013	MANISH AGARWAL	RP02590	Research Associate
10265	28-may-2013	31-mar-2014	GYANDSHWAR KUMAR RAO	RP02449	Research Associate
10312	16-sep-2013	15-sep-2016	POORNIMA SINGH	RP02802	Project Scientist
10334	20-aug-2013	19-feb-2014	AMRITA DAWN	RP02546	Senior Research Fellow
10364	01-oct-2013	30-sep-2016	P. SHARMILA	RP02821	Project Scientist
10391	01-oct-2013	31-mar-2014	RICHA SHUKLA	RP01924	Project Associate

5.3 No. of foreign students enrolled in M.Sc. & Ph.D. programmes Nil

5.4 No. of Indian and foreign faculty/researchers who have spent a sabbatical in the department

S. No.	Name	Faculty/Support	Duration	Outcome
1	Dr. Walid Elfellah, University of Tunis, Tunisia	Prof. S.K Khare/DST under CV Raman Fellowship for African National	November 2013	
2	Prof. Ayala Balan, Scientific Staff, Israel Institute for Biological Research, Ness-ziona, Israel	Prof. N.G. Ramesh/Self	October 1, 2010 – September 30, 2012	Papers under preparation

5.5 Sabbatical taken by faculty (2009-2013)

S.No.	Faculty	Place	Duration

1	Siddharth Pandey	Univ Missouri, Columbia, USA	May 2011 – April 2012

5.6 Number of seminars (education and research separately) given by the faculty

(i) in the department (25), (ii) in other departments, (10) (iii) at other institutions (several hundreds 600).

5.7 No. of faculty/researchers/scholars invited by the department for giving (i) Seminars (~300), (ii) spending at least a week in the department. (~21)

No. of faculty/researchers who visited the department on their initiative for giving (i) seminars (~160), (ii) spending at least a week in the department (11).

5.8 Adequacy of research infrastructure

In the past few years, there has been a major thrust to upgrade research infrastructure.

S. No.	Instrument	Make and Model	Funding	Facility	Approx. cost (in crores)	Year
1.	ESI-Mass spectrometer	Agilent	DST-FIST	Department	1.30	2011
2.	Confocal Fluorescence	Nanonics	DST-FIST	Department	1.1	2012
3.	Confocal Raman	Xplora (Horiba)	Institute	Department	0.50	2013
4.	GC-MS	Agilent	Institute	Department	0.40	2013
5.	500 MHz NMR	Bruker	DST (Award)	Department	5.00	2013
6.	Time Resolved Photoluminescence	Edinburgh Instruments	Institute	Central	0.80	2012
7.	Steady State Fluorescence	Edinburgh Instruments	Institute	Central	0.45	2012
8.	FTIR with many accessories	Agilent	Institute	Department	0.40	2013
9.	CD Spectrometer	AVIV	Institute	Department	0.40	2011

5.9 Adequacy of technical staff - existing numbers and competency areas; competency areas in which there is a shortage

We need more trained personnel to run our UG, PG and instrumentation laboratories. Shortage of trained technical staff has been a huge bottleneck whenever new, advanced and innovative ideas need to be implemented.

5.10 Work space available for (a) Masters students, (b) Ph.D. students, (c) project staff, (d) post doctoral scholars.

Almost non-existent at the present moment.

5.11 & 5.12 No. of conference/workshops/seminars attended by PhD students

National: 144
International: 19

5.13 No. of students who have continued to Ph.D. (i) in same dept., (ii) other departments of IITD, (iii) in India, and (iv) abroad

5.14 No. of projects with co-guide from industry Nil

5.15 No. of students who have spent time in industry as part of thesis/project work

M.Tech.: 2 (one year)

5.16 Self assessment reports of the department

5.17 Placement of M.Tech. and Ph.D. graduates in academic/technical careers

5.18 Inter-disciplinary work-: (i) joint thesis guidance by faculty across groups within a department, or across departments/centres, (ii) Proposals submitted and funded - PI Co PI and their group/department affiliations

Section 6

OUTREACH/EXTERNAL STAKEHOLDER ENGAGEMENT

6. Outreach / External stakeholder engagement

6.1 Educational

Faculty	Course	Type
Prof. A.K. Ganguli	Nano structured materials-synthesis, properties, self assembly and applications	Web
Prof. S.K. Khare	Structure and Functions of Biomolecule	Web
Dr. Pramit K. Chowdhury	Bio-physical Chemistry	Video
Dr. Shashank Deep	Bio-physical Chemistry	Web

Mentoring Innovation projects in different institutions

"Purification and Characterization of Cytochrome P450 from liver for the study of P450 interaction with anticancer drug molecule" (PI: Dr. Meenakshi Kuhar, Dr. N. Latha, Dr. Unnati Ahluwalia ….from Sri Venkateswara College, Delhi University) Mentor: SD

Maitreyi college (PI: Dr. Amirtha Anand) and Gargi college (PI: Dr. Vandana) Mentor: AR

6.2 Industry collaboration

(i) Consultancy- Glaxo-Smithkline-"Investigation of the Enzyme Inactivation Properties of Test Compounds" 2013 **(**SKK**)**
(ii) Three M.Tech. students (NJ, RS & AR) are carrying out one year project with R&D IOCL, Faridabad (2013-2014)
(iii) Two Ph.D. students are working at Daiichi Sankyo, Gurgaon with joint supervision (NJ)
(iv)An Indo-US workshop on "Pharmaceutical solids" was jointly held between IIT Delhi, IISC, Bangalore and Ranbaxy Laboratories, Gurgaon (February 2012) (AR)

6.3 Professional

Service as Board, Senate, selection committee member at other IITs, NITs and Universities

S.N	Name of Faculty	Professional Activities
1	AKS	Member: Board of Chemistry Studies Jamia Millia Islamia, New Delhi; Academic Council, IIT Indore; Governing Body Swami Shradhanand College University of Delhi; Board of Chemistry Studies NEHU 2007-2011
2	BJ	Member: Bioinformatics Task Force of DBT; DIT; ICMR,

		IUPAB National Committee, Chairman, Department of Biotechnology's committee on promotion and popularization of Biotechnology, Organic and Biochemistry DST-PAC Vice President, Indian Biophysical Society
3	AR	Member: Inorganic DST-PAC, International Advisory board, Elsevier
4	RS	Member: International advisory board of international conference ICCOC- GTL
5	SP	Member: Editorial Advisory Board, Vivechan International Journal of Research (ISSN No.: 0976-8211), Published by IMS Engineering College, Ghaziabad; Advisory Committee, National Funds for Basic, Strategic and Frontier Application Research in Agriculture of ICAR. Editorial Board: Scientific Reports, Published by Nature Publishing Group; ISRN Spectroscopy, Published by International Scholarly Research Network.
6	SKK	Member: NASI, Allahabad
7	RNR	Member: Advisory Board, Delhi Technological University, Gautam Buddha Technical Univ., Lucknow, NCERT

Positions (e.g. Director, Vice Chancellor, etc.) held by faculty on lien

(i) Prof. A.K. Ganguli, Director, Institute of Nano-Science & Technology, Mohali.
(ii) Prof. A.S. Brar, VC, GNDU, Amritsar

6.4 Contribution to national development goals

6.5 Alumni engagement

6.6 Recognition and Awards

Name of Award	Faculty
Shanti Swarup Bhatnagar Award, Stree Shakti Science Samman, AK Bose Memorial Award, Swarnajayanti fellowship, INSA Medal for Young Scientists, CRSI Bronze medal, B.M. Birla science award	CC
CSIR-Burhani Foundation Award, MN Desai National Award, Lockheed Martin Gold Medal	HMC
INSA Best Teacher Award, Tata Best teacher	AJE

award, Excellence in Teaching Award, IIT Delhi	
CNR Rao- CRSI National Prize, MRSI award, CRSI bronze medal	AKG
Endeavor Executive Award, Australia	VH
UNU Amway Award	SKK
CRSI bronze medal	BJ
NASI Scopus Young Scientist Award , Excellence in Teaching Award, IIT Delhi	SP
Excellence in Teaching Award, IIT Delhi	
Endeavor Executive award	VH
Excellence in Teaching Award, IIT Delhi, Outstanding young faculty fellowship	NJ
Excellence in Teaching Award, IIT Delhi,	NDK
Outstanding young faculty fellowship	SS
Outstanding young faculty fellowship	PKC
Outstanding young faculty fellowship	SN

Fellows of Science Academy	**Faculty**
The National Science Academy of Sciences	MNG
Indian Academy of Sciences	CC
Indian Academy of Sciences, The National Science Academy of Sciences	AKG
Biotech Research Society of India	SKK

Other Recognition

Editorial Boards

MNG: Sustainable Chemical Processes, Biocatalysis & Biotransformation, Enzyme Research, Indian J Biochemistry Biophysics, Molecules
BJ: J. Molecular Graphics & Modelling
CC: Pramana, J. Chem. Sci.
AKG: Bulletin of Materials Science, J. Chem Sci.
SP: Scientific Reports-NPG**,** ISRN Spectroscopy**,** Vivechan International Journal of Research (ISSN No.: 0976-8211)
SKK: Annals of Phytomedicine

Section 7

GOVERNANCE

7. Governance

7.1 Governance

(a) Organization structure - their autonomy/ terms of reference

The organizational structure and terms of reference are as per IIT Delhi statutes. Faculty members of the department actively participate in several Institute level administrative roles (e.g. Deans, Coordinators of facilities, Chairman and Member of several committees, In-charges of several UG/PG extra- and co-curricular activities, Hostel wardenships, Sports activities, Staff and institutional development etc.). Faculty members operate with complete autonomy in both teaching and research programmes following the guidelines laid out by IITD administration.

(b) Planning documents developed by the department - space, faculty, staff related.

DFB discusses all the policy related issues concerning space, budget, recruitments of faculty/staff, student related matter while DRC, COP and other sub-committees facilitates the function of

(c) Records of discussions within the department - internal documents

All minutes of the meeting are available in the department.

(d) Physical resources - percentage utilization for UG & PG core and electives teaching

(e) Financial resources

Funds received from IITD

Budget head	**2009-2010 (in lakhs)**	**2010-2011 (in lakhs)**	**2011-2012 (in lakhs)**	**2012-2013 (in lakhs)**	**2013-2014 (in lakhs)**
NPN05 (consumables)	56.27	62.00	86.00	100.00	95.00
PLN03 (non-consumables)	60.7	64.00	336.8	296.0	263.00
PLN03/F	3.60	3.60	3.60	3.60	4.50

PLN05	-	70.00	1.50	2.40	3.71
PLN6R	20.00	10.00	4.00	8.00	-
PLN3C	101.00	120.00	-	-	-

NPN05: Uses for Purchase of Chemicals & Glassware, spares of the Instruments, AMCs and other miscellaneous items in office and laboratories.

PLN03: Uses for procurement of Laboratories Instruments.

PLN05: Uses for procurement of Office furniture & fixtures.

PLN6R: Uses for procurement of Instruments

PLN3C: Special grants for Instruments & equipments used in the modernization of teaching laboratories.

Processes for distribution

Budget is periodically discussed at DFB and priority and distribution is drawn at DFB.

(f) Delegation of decision making within department. List the processes and structures for financial and academic management, and the methodology for their review.

7.2 Department management and operations

7.3 Faculty

Currently the department has 27 faculties which include 2 women. One is on lien. The faculties come from several regions (Punjab, Uttar Pradesh, Madhya Pradesh, Maharashtra, Uttarakhand, Bengal, Andhra Pradesh, Tamil Nadu, Kerala). They have obtained their doctoral degrees from different institutions in India (IITs, IISc, IACS, Punjab University, Delhi University, Lucknow university, SN Bose institute) and abroad (Cambridge university, Princeton, Iowa State University, Caltech). All of them have undergone postdoctoral training in India/overseas. A couple of them also have prior experience in national laboratories and industry.

Procedure for faculty recruitment

Rolling Advertisement

Recently, the department also recruited under Special drive initiated by IIT.

Short-listing based on institute minimum eligibility criteria, field of expertise based on department's needs, quality of publications in peer reviewed journals, interaction with chemistry faculty through Skype and in person. Short-listing done at two stages as per IIT norms.

Result of new faculty searches

Post	No. of applicants	Interacted	Short-listed For Interview	Joined
2013				
AP (Rolling Ad)	~450	26	5	1
Spl. Drv.	163	32	5	2

7.4 Students

(a) Criteria for short-listing and selecting students for admission to M.Sc., M.Tech. and Ph.D. programmes

M.Sc.: Admission through JAM.

M.Tech.: First class in M.Sc. with GATE Score >500 and performance in Interview. Relaxation is given for SC/ST/PH as per norms.

Ph.D.: Qualification in a National level exam (GATE, CSIR/UGC, DBT etc) or fellowship (DST-Inspire), Performance in the interview, Students choice for a particular discipline/faculty are considered.

(b) Facilities provided to students and their maintenance/management system.

The department is equipped with several state-of-art analytical and experimental facilities. Wherever possible, the department encourages students to independently operate the facilities. A few are also exclusively operated and maintained by TAs.

All Masters and PhD students have full access to the department facilities. In addition, individual faculty has many facilities in their research laboratories that are available to others.

(c) Mentoring seminars/sessions held for Ph.D. students for prospective faculty careers.

PhD students are generally mentored by their supervisors. Other faculty members (HOD, Chairman DRC, Programme Coordinator etc) also assist them whenever there is a need.

S.No.	Departmental Responsibility	Name of Faculty
1	Board of Postgraduate Studies	Ravi Shankar
2	Board of Undergraduate Studies	D.K. Bandyopadhyay
3	Computer Users Committee	Nalin Pant
4	ACL	Sunil Kr. Khare
5	AIC	Sameer Sapra
6	Institute Safety Committee	Ravi Prakash Singh
7	IRD Board	Anil J Elias
8	Undergraduate Curriculum Implementation Committee (UCIC)	N.D. Kurur
9	Postgraduate Curriculum Implementation Committee (PCIC)	D.K. Bandyopadhyay
10	DFB Convenor	Nalin Pant
11	Convenor, Committee of Professors	N.D. Kurur
12	M.Tech Coordinator	Nalin Pant
13	M.Sc. Coordinator	Sunil Kr. Khare
14	M.Sc Lab Incharge	J.D. Singh
15	M.Tech Lab Incharge	Nalin Pant
16	Seminars	Nidhi Jain
17	Chemical Society	P.K. Chowdhury
18	Time Table	S.Nagendran
19	Stores	A.J. Elias

20	Instrument Lab	Siddharth Pandey
21	Single Xtal	S.Nagendran
22	Powder XRD	Sameer Sapra
23	NMR (500 MHz)	Shashank Deep
24	NMR (300 MHz)	Nidhi Jain
25	Supporting Staff	J.D. Singh
26	Write Off Comm.	Ravi Shankar, J.D.Singh, V.Haridas
27	Book Suggestion Comm.	Ravi Prakash Singh, S.Nagendran, P K Chowdhury & S K Khare
28	Alumni, Liason & Placement	M.Sc, M.Tech. & Ph.D Coordinators
29	New UG Lab	Nalin Pant/P.K. Chowdhury
30	New Engineering Block	N.G. Ramesh
31	Department Space Committee	J.D. Singh, Sameer Sapra, S.Pandey
32	Advisory Cte. For ETSC	Dr.Sameer Sapra

Section 8

BENCHMARKING

8. Benchmarking

8.1 Identify departments/centres within lITD as peers

Physics, Chemical Engineering, CPSE

8.2 Identify departments/centres/schools/divisions from other IITs, IISc, NITs, private universities as peers, and reasons/criteria there for.

IITK, IITM, IITB,

8.3 Identify departments from institutions in other countries as peers

Refer Annexure

8.4 Define parameters for benchmarking (i) research, (ii) curriculum - separately for UG, Masters, and Ph.D. programmes, (iii) teaching-learning processes.

Curriculum: Number of courses in various disciplines

Research: Publications in peer reviewed journals of reputed chemical societies/publishers (ACS, RSC, Elsevier, Wiley, Nature, Science)

Impact factor, citations, recognition (awards, fellowships)

8.5 Perform benchmarking and report the analysis/findings for the last 5 years

Refer Annexure

Section 9

FEEDBACK SYSTEMS AND RESULTS

9. Feedback systems and results

9.1 System for feedback from UG students and its results

Academic section obtains feedback from all students (UG and PG) in every semester. In addition, all course coordinators conduct class committee twice a semester and gets feedback from students.

Feedback results for the past last six semesters

	II Sem 2010-11	**I Sem 2011-12**	**II Sem 2011-12**	**I Sem 2012-13**	**II Sem 2012-13**	**I Sem 2013-14**
No. of courses (UG, PG)	3, 13	2,15	2,15	5, 15	2, 15	3, 15
Average class size (UG, PG)	230.0, 39.2	198.0, 28.2	224.0, 31.0	139.0, 41.9	234.0, 33.2	190.6, 43.0
Max. scores (UG, PG)	3.9, 4.6	2.9, 5.0	3.7, 4.9	4.0, 4.7	3.5, 4.8	4.0, 4.6
Min. scores (UG, PG)	3.3, 3.2	2.9, 3.0	2.9, 2.9	3.8, 3.6	3.3, 3.3	3.7, 2.9
Average scores (UG, PG)	3.6, 4.0	2.9, 4.0	3.3, 4.1	3.9, 4.1	3.4, 4.1	3.8, 4.0

9.2 System for feedback from PG, Master's and Ph.D., students, and their outcome

9.3 System for feedback from recruiters

Most of the students graduating from different degree programmes invariably go for Ph.D. and post doctoral fellowships. A few opt for scientist or teaching jobs.

9.4 Mechanism of obtaining industry feedback and the findings

Currently the department is trying to engage the alumni employed in industries (IOCL, BPCL, Ranbaxy, Jubilant Organosys, Pfizer, Dr. Reddys, GE) to provide feedbacks.

9.5 Alumni feedback mechanism and its outcome

The department website has listed almost all students graduated in various degree programmes. It has created a link to obtain the current position of alumni and their feedbacks.

http://chemistry.iitd.ac.in/Alumni_html/alumni_main.html

In December 2012, the department organized a conference on “New directions in chemical sciences”. One session was dedicated to Alumni who are engaged in high quality research in different academic institutions, national laboratories and industrial R&D.

9.6 Placement records - Ph.D., M.Tech. and M.Sc.

Year	Faculty (Univ./colleges)	RA/Post Docs	Scientist in National Labs	Industry
2009	3	6	3	3
2010	6	-	2	
2011	7	4	5	3
2012	2	8	2	2
2013	-	2	-	1

Section 10

FEEDBACK SYSTEMS AND RESULTS

10. Future vision for next 5 years

Chemistry, *the* central science, interfaces as the bedrock across all dimensions of Science and Technology. As a Department with core expertise in chemical sciences, located within the Indian Institute of Technology Delhi, we see ourselves as a nodal point in the evolution of the Institute. We anticipate being able to contribute to the evolving research and pedagogy goals across a broad range of efforts – not only in the area of chemical sciences but also in all manner of interdisciplinary projects. In particular, the areas of advanced materials, chemical biology and environmental sciences come to mind. We wish to define the upcoming five years by translating this vision into practice, keeping in mind the overall institutional goals of excellence in research, teaching and societal impact. Here we see our contribution not just in terms of actual knowledge creation, but also in the training of students who can function and compete with the best in research and development environments in academia and industry.

10.1 Goals and benchmarking for the future

(i) Curricula

UG level

(a) IITs attract among the best students at the 10+2 level. At present, the department offers core and elective courses in chemical sciences accessed by UG students across the institute. This interface needs to be broadened to highlight the bedrock nature of a molecular world view.

(b) To emphasise the centrality of chemical sciences for a 21st century world, we would like to start a JEE entry 4 year B.S. with an optional 1 year M.S.. This proposed initiative would complement the efforts by other IITs, IISERs, IISc and leading universities to select and train good undergraduate students with a strong potential for research in basic and applied sciences.

PG level

(a) Believing that a Ph.D. degree is the basis to an interdisciplinary research career, it is our desire that access to this program be made more flexible that it is at present. In particular, we wish to move in a direction where, given the diversity of opportunity available within the IIT system, entry to our Ph.D. program is facilitated for talented students at all levels of preparation. This anticipates allowing greater flexibility in entry to the Ph.D. program, either via an Integrated Master's-Ph.D. program where select M.Sc. / M.Tech. students be encouraged to consider migration to Ph.D. program.

(b) Pre-Ph.D. Courses: Enhance Ph.D. level training by offering a strong complement of advanced post graduate level courses in:

(a) Computational chemistry, (b) Spectroscopy, (c) Materials science, (d) Chemistry-Biology interface, (e) Contemporary challenges in synthesis and exploration of novel opportunities in "chemical space".

We believe that these graduate level programs will strengthen not just the departmental research but also encourage cross-disciplinary research across the Institute.

(c) Modernization of teaching labs (B.Tech., M.Sc. and M.Tech.):

Our effort here is to, experientially reflect, thinking about the nature of investigative queries in the chemical sciences. We wish to allow students, at all levels of preparedness, to experience the transformation in our understanding of the phenomenological basis of classical methods of chemical analysis into present day instrumental based methods. This approach is in sync with the best practices followed in state of art academic and industrial R&D environments worldwide. The goal is to empower new learners to make informed decisions about career choices, whether in areas applied or more fundamental. The soon to be commissioned new chemistry lab (with a capacity to accommodate up to 120 UG students in a session) reflects our efforts in this direction. The new lab facilities are designed to reflect both recent analytical capabilities as well as the importance of the latest safety procedures.

(ii) Research

(a) Compliance of laboratories with international safety norms

(b) Expansion of laboratory space:

Worldwide, Chemistry, as an *experimental* science, predicated on a heavy reliance on instrumentation methods, requires a higher than normal per capita requirement of space. We are no exception to this trend. At present, *severe* space constraints, are a *major impediment to the expansion of our research goals. We envisage that a dedicated 'chemistry building' will go a long way to achieve our research ambitions.*

(c) Instrumentation: In the past decade, our Department has realised considerable achievements by creating infrastructure toward NMR, X-ray Crystallography, Optical spectroscopy and Imaging techniques. Enhancement of our research capability will rely on the further strengthening of these efforts.

Strengthening of existing facilities

Upgrading of existing facilities

- Crystallography: New powder and single crystal diffractometers
- Cryo-probe for the 500 MHz NMR machine
- Microscopy – Upgrading existing fluorescence and Raman Confocal microscopes to focus on creating a state-of-the-art microscopy and imaging facility both at the ensemble and the single molecule level. To combine AFM with the existing confocal single molecule system; also upgrade the existing system to FLIM; super-resolution microscopy

New facilities

- Creation of a strong NMR facility - Solid State NMR
- Femtosecond facility - Both pump-probe and fluorescence upconversion
- Solar cell fabrication and characterization
- Small angle X-ray scattering

Facilities to be procured for the next five years: (a) Single crystal, (b) Solid state NMR, (c) Cryoscope for existing 500 MHz NMR, (d) Ultrafast (femtosecond system), (e) Small angle X-ray scattering

High Peformance Computing Facility: The institute has plans for an HPC centre and the chemistry department envisages playing an active role in the creation and usage of such an interdisciplinary facility

Proposed equipments under Central Facility

(i) XPS, (ii) EXAFS, (iii) THz, (iv) SQUID magnetometer

(e) Research Areas to be strengthened on existing faculty strengths

(i) *Catalysis*

(ii) *Drug design, -omics and Chemical Biology*

(iii) *Materials oriented toward energy, environment and sustainability issues – nanomaterials, sensors*

(iv) *Biomolecular Structure and Dynamics*

(v) *Applied enzymology and microbial biochemistry*

(vi) *Computational and Theoretical Chemistry*

(vii) *Advanced Spectroscopy*

(f) New research areas: These are areas in which there are lacunae in faculty expertise and require strengthening:

(i) Quantum chemistry, (ii) Chemistry-biology interface, (iii) Innovative materials, (iv) Physical organic chemistry

(g) Skilled manpower: Creating a pool of high-quality postdoctoral researchers using different funding resources

(h) Industry-academia links: Major drive towards industry-academia collaboration will be at the forefront of our goals and outreach.

(iii) Outreach

- The department plans to utilize the UG facility to run short-term laboratory courses for schools and colleges to provide them hands on experience.
- Running workshops for school and UG college students e.g. INSPIRE and Indian Academy of Science workshops.
- Lectures that address issues related to the public understanding of science, with special relevance to chemistry.

(iv) Processes for regular internal assessment

- Monitoring of peer-reviewed publications in terms of both quality and impact (citations, impact factors, number of publications.
- Monitoring of student placement (M.Sc. And Ph.D.) in terms of academic, industry and career placement.
- National and international collaborations (Projects/Publications/Student Exchange/ technology transfer to industry)
- Participation in professional activities: (i) conference organization (ii) editorial boards (iii) national and international committees
- Indian and international patents
- Research Funding: Sources, amount, project diversity and impact

10.2 Vision of curricula and teaching-learning processes - UG, PG and Ph.D.; innovations proposed

- Our goals in terms of departmental curricula are given under 10.1(i).
- To develop more NPTEL programs and web-based and video based teaching modules
- Consider emerging formats such as MOOCs

10.3 Areas identified for improvement in (i) curriculum, (ii) teaching-learning processes

- Introduction of new experiments with bench-top instruments to expose UG/PG students toward modern chemical analysis
- Flip teaching and problem based learning
- Journal clubs/seminar participation
- Involving TA in teaching programs

10.4 New areas for research and Masters programme and industry participation in these

Academic institutions, by definition, are places where individual researchers enjoy the freedom to explore and define their own goals. While we have been specific about research areas in which we plan to expand our activities, we feel that many of the new research areas, pedagogies and industry collaboration emerge naturally in good

departments. Our effort is to create an environment that fosters academic creativity and productivity.

10.5 **Projections for (i) funded projects, (ii) journal publications**

Funded projects: 6-8 crores per year

Journal publications: 120 per year

10.6 **Projected graduation numbers**

Ph.D.	20
M. Tech.	20
M. Sc.	55

10.7 Projected faculty profile, and areas for recruitment of faculty

Chemical biology
Innovative materials
Quantum chemistry
Nanochemistry/Soft matter

10.8 Projections for future benchmarking (for comparison after 5 years) – institutions in India and abroad, and parameters for future comparison

Our markers for internal assessment should be consistent with those that can be used for comparison with similar institutions in India and abroad. For this purpose, we believe that the following are appropriate:

Peer-reviewed publications, student placement, national and international collaborations, participation in professional activities, Indian/ international patents, research Funding, National and international awards and recognition

10.9 Infrastructure and governance – limiting factors that affect achievement of benchmarks and methods to overcome these

State-of-the-art chemistry research is extremely instrument intensive. In recent times the departmental instrument infrastructure has been upgraded extensively. There are three main areas that keep the department from meeting our own academic expectations:

- Space
  -lack of it as well as it being scattered over various locations on campus
  -a separate building for Chemistry department
- Manpower at the middle level, such as postdoctoral fellows and skilled technical staff
  -recruitment of more post doctoral fellows
  -part time/contract technical staff

- Administrative support

10.10 Working with other departments/centers and institutions in teaching and research

A number of faculty members have collaborative projects with groups in other departments/centers/institutes. The DAAD fellowship for M. Tech. Students has proved useful to forge relationships with a number of universities in Germany. The IITD-EPFL memorandum of understanding has fostered partnerships between the chemistry departments at the two institutes.

The Department is in the process of considering a proposal from the Chemistry Department of the University of Durham for collaborative projects.

10.11 New initiatives that the department will undertake

Refer above

10.12 Outreach goals and anticipated limitations in the attainment of these

Educating high school science teachers on a workshop mode during vacation period.
Attracting DST-Inspire and similar students to pursue summer research in the department.

10.13 Mechanisms for effective changes based on feedback received and development and implementation of corrective measures

Every course that is taught has a committee, called the class committee, which has a few student representative. The Head of the department meets with the class committees of all courses once (half-way through the semester) and gets the feedback of the students on the course. This is conveyed to the teacher if corrective measures are required.

The Head of the department meets with the technical staff periodically to elicit their views on the state of affairs.

In addition to informal meetings, the Faculty of the department meet formally once every two months (on an average) to discuss matters of relevance to the department. Constructive criticism from all the committee members helps us to move forward. The Departmental Faculty Board along with other executing committees (Departmental Research Committee, and Committee of Professors) take suitable course of action to implement the suggestions/guidelines.

10.14 Questions to which the department seeks answers from the Review Committee

(a) How do we tap funding resources toward maintenance, new building/facility etc?

(b) How do we ensure that more M.Sc. students receive financial support?

(c) Is it advisable to create corpus funds for various departmental expenses such as maintenance of instrumental facility, library resources?

Section 11

Information in Public Domain

11.1 Minute of all meetings

Minutes of all meetings are available with the convenors of different committees.

11.2 All reports archived

All reports of sponsored and consultancy projects are with the PI's of those projects and submitted to IRD.

11.3 Past vision documents, review documents, Standing review committee documents

11.4 Any other documents developed by the department

11.5 Feedback documentation and action taken on the same, and its outcome