

# Department of Chemistry

## Kumaun University

### Uttarakhand 263002

The Department of Chemistry, established in 1977 (under university status), is one of the most prestigious departments of the science faculty that runs M. Sc. and Ph.D. programmes.



It also offers courses in basic chemistry to all UG students. It is engaged in research on chemistry of natural products, synthesis of biologically active organic compounds, medicinal plants, Bio organic analysis, biogenesis of bio molecules, metal complexes, Organometallic, Ionic dynamics of central Himalyan water resources, water chemistry, soil chemistry, chemical kinetics and catalysis, fluorescence spectroscopy, supra molecular and surface chemistry, chemical evolution and nanomaterials. The expertise of the Department in above areas is well recognized. The Department is well equipped with modern analytical facilities like GC, GC/MS, HPLC and FT-IR. Both the campuses i.e. Almora and Nainital have their own departmental libraries.



The executives of various Industries visited the Department for career counseling. Five P.G. students are selected as Chemists in the M/s Jubilant Organosys in the year 2010. The P.G. students were also selected in higher education, CDRI, CIMAP, ICMR, Dabar India and Morpen Pharmaceuticals etc.

### 3. Course Curriculum

At undergraduate level, it has a three years degree course comprising of Inorganic, Organic and Physical Chemistry including laboratory classes related to all these branches. The postgraduate course structure is of two years duration. The M.Sc. previous course consists of Inorganic Chemistry (CH-401), Organic Chemistry (CH-402), Physical Chemistry (CH-403), Group Theory, Analytical Methods and Spectroscopy (CH-404) and Computer for Chemists (CH-405) including laboratory classes (CHL-406) related to these five branches. In the M.Sc. final year there are three specializations viz. Inorganic Chemistry, Organic Chemistry and Physical Chemistry. Each of these specializations consists of two compulsory papers, Spectroscopy and Solid State Chemistry (CH-501) and Bioinorganic Chemistry, Bioorganic Chemistry and Biophysical Chemistry (CH-502) and three optional papers in each specialization. The details of the specializations are as follows:

#### Specializations/Elective Courses

##### Inorganic Chemistry

- CH-503I General and Organometallic Chemistry
- CH-504I Inorganic Polymers & Supramolecular Chemistry
- CH-505I Photo-inorganic Chemistry
- CH/L-506I Laboratory course

##### Organic Chemistry

- CH-503O Organic Synthesis
- CH-504O Chemistry of Natural Products & Heterocyclics
- CH-505O Medicinal Chemistry
- CHL-506O Laboratory course

##### Physical Chemistry

- CH-503P Physical Organic Chemistry & Quantum Chemistry
- CH-504P Chemical Dynamics & Thermodynamics
- CH-505P Nuclear Chemistry, Photochemistry & Electrochemistry
- CHL-506P Laboratory course

## **4. Infrastructure developed and Major equipments**

- **Advanced Centre for GC-MS Facility**

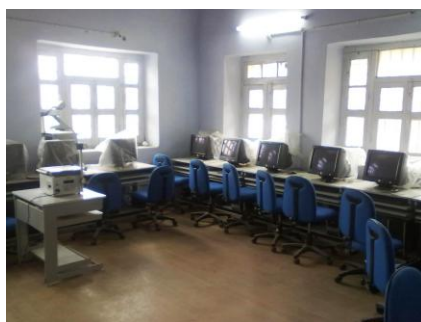
The GC-MS centre established with the financial assistance from the DST is being used as central facility. This instrument has computerized facility to analyze/estimate and characterizes the major/minor or trace constituents of any extract/mixture with adequate volatility. For solid /non-volatile samples MS can be taken through DIP attachment. This is a very useful facility for analyzing chemicals/drug constituents and aroma constituents of plant materials, even in trace quantities.

- **DST-FIST Department**

The Department of chemistry has been identified by the Department of Science and Technology under the FIST programme. Under this programme the department has been sectioned Rs. 25 lakhs for modernization of laboratories and FT-IR instrumentation for a period of 5 years.



**Chemistry PG and research lab  
at DSB Campus Nainital**



**Computer lab at Chemistry Department, SSJ Campus, Almora.**

- **Major Equipments ( D S B Campus, Nainital)**

(i) **FT-Infra Red Spectrophotometer**, (Perkin Elmer, England)



(ii) **UV-Vis Spectrophotometer**, (Hitachi, Japan)

(iii) **HPLC** (Waters, USA) and **HPLC** (Thermo Electron)



(iv) **Gas Chromatograph**, (Nucon)

(v) **GC/MS**, (Thermo Finnigan MAT)



## 5. Number of seats with specialization of the courses at PG Level:

	S S J Campus, Almora	D S B Campus, Nainital
Organic Chemistry	25	20
Physical Chemistry	05	05
Inorganic Chemistry	--	05

\*The number of seats is interchangeable.

## 6. Research Activities

The research work on the following areas/disciplines is being pursued by the faculty members

### Plant Chemistry

- ❖ Landscape and biodiversity and molecular characterization of medicinal/aromatic plants of Uttarakhand Himalayan region.
- ❖ Chemistry Department of the Kumaun University has made considerable efforts towards the investigation on different aspects of medicinal and aromatic flora of this region.
- ❖ More than 50 species (with over 170 research publications) have been worked out.
- ❖ Main focus of the research activities has been the high altitude plants of medicinal and commercial importance for their utilization and regeneration including the endangered species.
- ❖ This Department has main thrust on researches on chemistry and application/utilization oriented work on medicinal and essential oil bearing plants.
- ❖ Keeping the research activities and out-put in view, UNESCO Chair in Medicinal Plants has been approved by Govt. of India.

## Bio-organic chemistry

Studies on some aspects of clay initiated prebiotic synthesis of biomolecular matrices of living systems.

## Reaction kinetics and Co-ordination polymers

Kinetics of redox processes with a view to explore the probability of new/alternative oxidants, examine the role of suitable catalysts at different pH-levels in industrial processes and to explore the possibility of redox reactions at lower temperatures.

## Inorganic chemistry

- Studies on metallo-organic/ organometallic derivatives having potential bioactivity.
- Work on coordination polymers and metal-ligand equilibria.
- Characterization and biocidal applications of 3d metal complexes with multidentate schiffs bases
- Ionic dynamics of Central Himalayan water resources.
- Soil chemistry in relation to heavy metal pollution.

## Inter-disciplinary programmes started

Interdisciplinary research on herbal medicine and aromatic plants has been initiated by signing MoU with

**(i) Jubilant Organo Sys**

**(ii) Defence Research Laboratory**

The researchers of Kumaun University could get the facilities of NMR, LC/MS, amino acid analyzer and other sophisticated instruments in these institutes and research labs of the industries involved in MoU.

## 7. Sponsored research projects:

1. **DST, New Delhi** sponsored project “Chemical Investigation of aromatic and medicinal plants of Kumaun and Garhwal regions of Himalaya” of Rs. 1, 00, 74, 235/- starting date: 01<sup>th</sup> October 2000 to 30 September 2010. **PI-Prof. C. S. Mathela**
2. **GBPI-IERP** sponsored project “Development of high grade medicinal plants in Uttarakhand” of Rs. 6, 52, 000/- starting date: 01<sup>th</sup> December 2007 to 30 November 2010. **PI-Prof. C. S. Mathela**
3. **UCOST, Dehradun** sponsored project “Investigation on chemical diversity of Himalayan aromatic and medicinal plants and chemical modification of their constituents for commercial” of Rs. 3, 74, 900/- starting date: 28<sup>th</sup> April 2009 to 27 April 2011. **PI-Prof. C. S. Mathela**
4. **Central Himalayan Environment Association, Nainital** sponsored project “Swasth Jeewan Shailee Swachh Paryavaran” environmental awareness programme of Rs. 1.5 lakhs starting date: March 2004 to 31<sup>th</sup> March 2010. **PI-Prof. Ganga Bisht**
5. **UGC, New Delhi** sponsored project “Bioactive xanthenes and their quantification from the Himalayan plants of Swertia genus” of Rs. 10.5 lakhs starting date: 1<sup>st</sup> February 2009. **Co-PI-Prof. Ganga Bisht**
6. **UCOST, Dehradun** sponsored project “Investigation of terpenoid composition and antimicrobial activity of some medicinal and aromatic plants of family Lamiaceae” of Rs. 7.5 lakhs starting date: 1<sup>st</sup> October 2007 to 31<sup>st</sup> March 2010. **PI-Prof. A. B. Melkani**
7. **USERC, Dehradun** sponsored project “Remedial Strategies for metal contaminated soils using *Mentha* and *Ocimum* species” of Rs 7.1 lakhs (first year) starting date: 20<sup>th</sup> February 2010. **PI-Dr. Chitra Pande**

8. **UCOST, Dehradun** sponsored project “Studies of heavy metal contamination on agricultural soils and dominant crops as pollution indicator in Tarai region of Kumaun Himalaya” of Rs 2,73,900.00 (first year) starting date: 19<sup>th</sup> September 2009. **PI-Dr. Geeta Tewari**
9. **UCOST Dehradun** sponsored project “Syntheses, characterization and catalytic activities of nano-sized double metal cyanide complexes” of Rs. 7.34 Lakh starting date: 8<sup>th</sup> September 2007 to 7<sup>th</sup> September 2010. **PI-Dr. Shah Raj Ali**
10. **CSIR New Delhi** sponsored project “Electrocatalytic potential of nanoscaled metal hexacyanometallate-carbon nanotube composite and its application in voltammetric determination of salbutamol, paracetamol, morphine and codeine drugs” of Rs. 16.00 Lakh starting date: 15<sup>th</sup> January 2009 (duration three years). **PI-Dr. Shah Raj Ali**
11. **UGC New Delhi** sponsored project “Syntheses, characterization, catalytic and antimicrobial activities of metal hexacyanocobaltate nanoparticles” of Rs. 9.45 Lakh starting date: 10<sup>th</sup> February 2009 (duration three years). **PI-Dr. Shah Raj Ali**
12. “Chemical investigation on Artemisia species of Uttarakhand Himalaya and chemical variation with respect to environmental factors” of Rs 7.25 Lakh Duration 3 years **PI – Dr G C Sah.**
13. G S M L Project (UICIT, Bombay) “potential bioactive flavonoids from activity guided fractionation of aqueous ethanoic extract of Himalyan Artemisia species”- **PI - Dr D L Verma.**
14. **UCOST Dehradun** sponsored project, “Catalytic Hydrogenation of Organic Substrates by using ZSM-5 anchored Pd(II) Complexes.” 5.12 Lakh, 2008-10 **PI-Dr. P Sagar.**
15. **UCOST Dehradun** sponsored project, “Synthesis Characterization and in vitro antimicrobial screening of alkyl and aryl tin(IV) complexes with phenol derivatives derived from amino acid.” Rs. 6.15 Lakh, 2009-11 **PI-Dr. R Aman.**

## **8. Workshop, Seminars, Symposia Organized**

- The Department has organized an outreach programme on Fulbright fellowships in November 16, 2006, at Nainital
- The Department has conducted a National Workshop on Computers in Chemistry from 22<sup>nd</sup> November to 24<sup>th</sup> November 2007, sponsored by Uttarakhand State Council for Science and Technology, Dehradun, at Almora.
- The Department has conducted a UGC sponsored Refresher Course in Chemistry 17<sup>th</sup> February to 8<sup>th</sup> March 2009 and has given training to teachers of Indian Universities and Colleges, at Nainital.
- The Department has conducted a State workshop on Digital Instruments and Computers for Chemistry Laboratories from 4<sup>th</sup> March to 6<sup>th</sup> March 2010 with the collaboration of Science Education Center and Sponsored by Uttarakhand State Council for Science and Technology, Dehradun, at Almora.

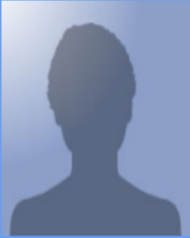


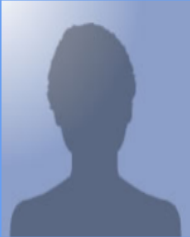
## **9. Number of Publications (2005 – 2010)**

**(a) Number of papers published in refereed journals: 100**

**(b) Number of books published: 03**

**(c) Research papers presented in conferences, seminars: 47**





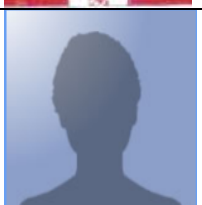
## 10. Faculty and their Contact numbers and e mails:

Faculty Members: Department of Chemistry, S S J Campus, Almora. Phone No. 05962 235430					
	Name	Designation	Specialization	Contact Numbers	E-mail
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**Faculty Members: Department of Chemistry, D S B Campus, Nainital.**  
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Prof. K. S. Khetwal

- (a) Designation: Emeritus Scientist
- (b) Specialization/Area of interest: Organic Chemistry / Natural Products Chemistry
- (c) Research papers published: 05
- (d) Ph.D. awarded: 07
- (e) Research projects: 04

S. No.	Title	Sponsoring agency	Duration	Amount
1.	Bioassay guided fractionation of high altitude Himalaya herbs	D.S.T., New Delhi	2001-2005	7.5 lakhs
2.	Genetic profiling of six elite species for the pilot production of bioactive molecules	D.B.T., New Delhi	2003-2006	7.5 lakhs
3.	Bio-Dynamics from high altitude Altai and Himalayan mountains	Indo-Russian Academy of Sciences	2002-2006	-
4.	Bioactive xanthenes and their quantification from the Himalayan plants of Swertia genus	UGC, New Delhi	1 <sup>st</sup> February 2009	Rs. 10.5 lakhs

Award/ membership:

Journal of Indian Chemical Society

Indian Society for Chemists and Biologists

American Chemical Society (2010)

Invited/special lectures delivered in University/Seminar/Symposia: 10

Conference/Symposia/Workshop/Training attended: 10

## 11. Number of students awarded Ph. D. (2005-2010)

D S B Campus, Nainital			S S J Campus, Almora		
1	Prof. C. S. Mathela	07	1	Prof. N. D. Kandpal	04
2	Prof. G. Bisht	04	2	Dr. S. K. Joshi	01
3	Prof. S.P.S. Mehta	04	3	Dr. G. C. Sah	01
4	Prof. A. Adhikari	01	4	Dr. D. L. Verma	04
5	Prof. A.B. Melkani	03	5		
6	Prof. C.K.Pant	01	6		
7	Dr. C. Pande	03	7		

## 12. Proposed activities in future

### Proposed Academic Activities for 2010-2011

#### (1) National Symposium:

**Title:** “National Symposium on Emerging Frontiers in Chemical Research”

**Broad Subject area :** Drugs from natural resources  
Nanotechnology  
Green chemistry

**Objectives:**

The primary objective of this symposium is to promote the advance research in all the interdisciplinary areas of chemical science by bringing the people from different areas of chemical science under one shed. One more purpose of this symposium is to boost up the young scientists to connect their research with green objectives and perform the classical research keeping in mind the principles of green chemistry. The symposium is also aimed to encourage the young researchers to involve nanotechnology in their research areas and perform the collaborative research of interdisciplinary areas.

**Organizing committee:** Chief Patron : Prof. V.P.S. Arora  
Chief Advisor : Prof. C.S. Mathela  
Coordinator : Prof. G. Bisht & Prof. S.P.S. Mehta  
Org. Secretary : Dr. S. R. Ali  
Members : Prof. A.Adhikari, Prof. A.B.Melkani,  
Prof. C.K.Pant, Dr. P. Joshi, Dr. C. Pande & Dr. G. Tewari

**(2) Refresher Course:**

**Title:** New Frontiers in Chemical Education

**Objectives:**

- 1.To provide an opportunity for the participants to have open discussion with the eminent resource persons of the frontier area.
2. To explore the interdisciplinary approach of the topic selected herein.
3. To explore the recent advancements in the areas of topics selected herein.
4. To promote and excite the participants to work in the emerging interdisciplinary branches of chemical sciences.

5. To introduce the participant with new teaching and learning methods in chemical sciences including computer based techniques.

**Organizing committee:** Coordinator : Prof. G. Bisht & Prof. S.P.S. Mehta  
Chief Advisor : Prof. C.S. Mathela  
Members : Prof. A.B. Melkani  
Prof. C.K. Pant  
Dr. S. R. Ali