

हिमाचल प्रदेश केंद्रीय विश्वविद्यालय

Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

(Temporary Academic Block, Shahpur)



MINUTES

**SIXTH BOARD OF STUDIES MEETING  
HELD ON 14<sup>TH</sup> DECEMBER, 2016 AT 10.30 AM.**

**Venue: Committee Room, Temporary Academic Block,  
CENTRAL UNIVERSITY OF HIMACHAL PRADESH,  
Shahpur , District Kangra(HP)**



(478) (2/16)

**हिमाचल प्रदेश केंद्रीय विश्वविद्यालय**  
**Central University of Himachal Pradesh**  
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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
(Temporary Academic Block, Shahpur)

File No. EES/1-12/DRC/CUHP/15/

Dated: 14<sup>th</sup> December, 2016

**MINUTES**

1. The 6<sup>th</sup> Board of Studies (BOS) meeting of Department of Environmental Sciences was held on 14<sup>th</sup> December, 2016 at 10.30 AM at Central University of Himachal Pradesh, Temporary Academic Block (TAB), Shahpur. The following were present:

1.	<b>Dr. Deepak Pant</b> , Associate Professor & Head, Department of Environmental Sciences, Dean, School of Earth and Environmental Sciences	<b>CONVENER &amp; CHAIRMAN</b>
2.	<b>Prof. H. Tombi Singh</b> Ex-Vice Chancellor, Manipur University, Imphal (Manipur)	<b>SUBJECT EXPERT</b>
3.	<b>Dr. Adarsh Pal Vig.</b> Department of Botanical and Environmental Sciences, GNDU, Amritsar	<b>SUBJECT EXPERT</b>
4.	<b>Prof. Ambrish Kumar Mahajan</b> , Professor, Department of Environmental Sciences, Central University of Himachal Pradesh	<b>MEMBER</b>
5.	<b>Dr. Mushtaq Ahmed</b> Associate Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	<b>MEMBER</b>
6.	<b>Dr. Ankit Tandon</b> Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	<b>MEMBER</b>
7.	<b>Dr. Vikram Singh</b> , Assistant Professor, Centre for Computational Biology & Bioinformatics, School of Life Sciences, Central University of Himachal Pradesh.	<b>MEMBER (VC NOMINEE)</b>

The following member could not attend the meeting due to prior assignments and was granted leave of absence:

1.	<b>Dr. O.S.K.S. Sastri</b> , Associate Professor & Dean, School of Physical and Material Sciences, Central University of Himachal Pradesh.	<b>MEMBER (VC NOMINEE)</b>
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2. Dr. Deepak Pant, Dean, School of Earth and Environmental Sciences (Convener & Chairman of the BOS) welcomed all the members and thanked them for being available for attending this meeting.

**THEREAFTER, THE AGENDA ITEMS WERE TAKEN UP AS UNDER:**

**ITEM NO: ENV-BOS-6/15-1**

Confirmation of the Minutes of the 5<sup>th</sup> Meeting of the Board of Studies held on 22<sup>nd</sup> February, 2016.

**The Minutes of 5<sup>th</sup> Meeting of the Board of Studies (BOS) held on 22<sup>nd</sup> February, 2016 were confirmed.**

**ITEM NO: ENV-BOS-6/15-2.**

*Adh*

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*V. Singh*

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**TABLE-I: Revised Curricular Framework" for M.Sc. in Environmental Sciences based on Choice Based Credit System (CBCS) (Year 2016)**

Semester	Credits	Core- Compulsory	Credits	Credits	Core- Open	Credits	
I	16	ENV 402a – Introduction to Earth Processes	2				
		ENV 403 - Environmental Chemistry	4				
		ENV 434 - Fundamentals of Ecology and Environment	4				
		ENV 516 - Atmospheric Science	2				
		ENV 435 - Environmental Sciences Laboratory – I	2				
		ENV 404 - Energy and Environment	2				
II	12	ENV 408 - Biodiversity and Wild Life Management	2	4	ENV 523 - Toxic and Hazardous Waste Management	4	
		ENV 432 - Introduction to Statistical Techniques	4		ENV 569 - Environmental Pollution and Health issues	4	
		ENV 424 – Fundamentals of Remote Sensing	2		ENV 535 - Natural Hazards	2	
		ENV 422- Basics of Natural Resource Conservation	2		ENV 525 - Environmental Geochemistry	2	
		ENV 436 - Environmental Sciences Laboratory – II	2		ENV 553 - Environmental Thermodynamics	2	
					ENV 503 – Environmental Legislation: National & International	2	
III	4	ENV 524 - Environmental Impact Assessment	2	4	ENV 508 – Environmental Ethics	2	
		ENV 571 - Remote Sensing and GIS Lab	2		ENV 572 - Land Use Planning	2	
					ENV 573 – Water Resource Management	2	
					ENV 546 Renewable and Non renewable Energy potential in HP State	2	
IV	8	ENV 575 – M.Sc. Dissertation	6	4	ENV 557 - Bio-resources and Environmental Biotechnology	4	
		ENV 412- Analytical Technique	2		ENV 537 – Environmental Engineering	2	
					ENV 421 – Municipal Solid Waste Management	2	
					ENV 428 – Himalayan Geology	2	
					ENV 574 - Bio Analytical Techniques	4	
		ENV 561 – Science of Climate Change	2				
III	8	ENV 559 - Environmental Geophysics	2	IV	8	ENV 521 – Geo Engineering	2
		ENV 411 - Waste Management	2			ENV 577 - Carbon Management	2
		ENV 550 – Microbial Ecology	2			ENV 409 – Environmental Microbiology	2
		ENV 611 – Atmospheric Chemistry	2			ENV 613 – Atmospheric Physics	2
		ENV 410 – Environmental Biotechnology	2			ENV 579 - Recent Trends in Environmental Biotechnology	2
		ENV 578- Introduction to Glaciology	2			ENV 580 - Recent Trends in Glaciology	2
		ENV 530 Green Chemistry and Environment	2			ENV 555 Emerging Ethical Issues for Nanotechnology in Environment	2

To place before the BOS the revised "Curricular Framework" for M.Sc. in Environmental Sciences based on Choice Based Credit System (CBCS) (Year 2016-17) adopted by the University in its 13<sup>th</sup> Academic Council Meeting held on 15<sup>th</sup> June, 2015 vide ITEM NO: 13.10 (T) (Table-I). (200) (174)

The BOS discussed the revised Curricular Framework (based on Choice Based Credit System) (CBCS) and approved as shown in table-I below.

ITEM NO: ENV-BOS-6/15-3.

To place before the BOS "Curricular Framework" of Human Making and Skill Development courses to be offered by the Department of Environmental Sciences based on Choice Based Credit System (CBCS) adopted by the University in its 13<sup>th</sup> Academic Council Meeting held on 15<sup>th</sup> June, 2015 vide ITEM NO: 13.10 (T).

Table 2: List of Foundation Courses (Human Making and Skill Development)

Under Graduate Level

S. No.	Name of the Faculty Member	Course Name for Human Making	Course Code
1.	Dr. Anurag Linda	Basics of Environmental Studies*	ENV 121
2.	Dr. Ankit Tandon	Environmental Issues and Policies*	ENV 122

Post Graduate Level

S. No.	Name of the Faculty Member	Course Name for Human Making	Course Code
1.	Prof. A. K. Mahajan	Earthquake Awareness*	ENV-437
2.	Dr. Deepak Pant	Carbon Management	ENV577
3.	Dr. Mushtaq Ahmed	Principles of Biodiversity and Wildlife Conservation*	ENV439
4.	Dr. S. Chatterjee	Environmental Ethics	ENV 508
5.	Dr. Dilbagh Singh	Energy and Environment	ENV 404

S. No.	Name of the Faculty Member	Course Name for Skill Development	Course Code
1.	Prof. A. K. Mahajan	Disaster Management	ENV-536
2.	Dr. Deepak Pant	Waste Management	ENV - 411
3.	Dr. Mushtaq Ahmed	Microbes and Sustainable Development*	ENV440
4.	Dr. Ankit Tandon	Basics of Climate Change*	ENV 443
5.	Dr. S. Chatterjee	Contemporary Environmental Issues	ENV 547
6.	Dr. Anurag Linda	Water Resource Conservation in Hilly Region*	ENV441
7.	Dr. Dilbagh Singh	Nano-techniques and Environment	ENV 528

† For Under Graduate Level

\* Courses to be introduced

The BOS discussed the list of courses as given in table 2 above and approved the same.

ITEM NO: ENV-BOS-6/15-4

To approve the list of paper setters for the End-Semester examinations for the Department of Environmental Sciences as adopted by the University in its 16<sup>th</sup> Academic Council Meeting held on 65<sup>th</sup> June, 2016 vide ITEM NO: 16.11 vis-à-vis Ordinance 30.

*Anil*

*Vinay*

*Omprakash*

*M*

*Abh*

*K*

*Dr. Singh*

Clause 12 (b) and 22 (a) of Ordinance 30 (approved/amended vide item No. 16.11 of the minutes of 16<sup>th</sup> Academic Council) of the Central University of Himachal Pradesh are reproduced below:

1. Clause 12 (b), "The question paper for End-Semester examination of a course shall be set and evaluated by the external examiner".

2. Clause 22 (a), "For selecting the paper setters for the End-Semester examinations, the Controller of Examinations shall seek a panel of at least five paper setters / evaluators for each course from the Head / Director of the department / centre as approved by the Board of Studies.

Provided further that the concerned faculty members shall submit a list of examiners (who are not members of Board of Studies and School Board) to the Head / Director of Department / Centre who

in turn will get the examiners approved from the Board of Studies".

Accordingly, each faculty member of the Department, teaching a particular course was requested to provide the list of paper setters for the End-Semester examinations for that course. The compiled list for approval by the BOS is placed as in Table 3 below.

**Table 3: LIST OF EXTERNAL PAPER SETTERS (ORDINANCE 30)**

**PROF. AMBRISH KUMAR MAHAJAN**

S.No	Name	Address	Papers to be set
1.	Prof M.L. Sharma	Department of Earth Engineering, IITR, Roorkee, Sharma.mukat@gmail.com	ENV 564 (Near Surface Geophysics ) and ENV 559 (Environmental Geophysics)
2.	Prof RVS Yadav,	Kurukshetra University, email :rbsybhu@rediffmail.com	
3.	Prof. Dr Aanad Joshi,	IIT, Roorkee, email : anandfes@iitr.ac.in	
4.	Prof. S.S. Teotia,	Kurukshetra University, email : teotia_ss@rediffmail.com	
5.	Dr S.C. Gupta,	Department of Earth engineering, IITR, Roorkee, email : scgeqfeq@iitr.ac.in	
6.	Dr Gautam Rawat,	Scientist E , WIHG, Dehradun, email : rawatg@wihg.res.in	
1.	Prof M.L. Sharma,	Department of Earth Engineering, IITR, Roorkee, email: Sharma.mukat@gmail.com	Disaster Management (ENV 536)
2.	Prof. Chandan Gosh,	National Institute of Disaster Managements, email: cghosh24@gmail.com	
3.	Prof. Sandeep Pandita,	Department of Geology, Jammu University, email: sandeep.pandita@gmail.com	
4.	Dr O.P. Mishra,	Ex- Director SAARC, Disaster Management, Ministry of Earth Sciences, email : opmishra2010.saarc@gmail.com	
5.	Dr Naresh Dhatwalia,	WIHG, Dehradun, nkd@wihg.res.in	
6.	Dr. Jitender Kaur	Department of Botanical and Environmental Sciences, GNDU, Amritsar	
1.	Prof M.L. Sharma,	Department of Earth Engineering, IITR, Roorkee, Sharma.mukat@gmail.com	Earthquake Awareness

Amr... Singh... Mahajan... [Handwritten signatures and initials]

2.	Dr Naresh Dhatwalia,	WIHG, Dehradun, email : <a href="mailto:nkd@wihg.res.in">nkd@wihg.res.in</a>	(ENV 437) 210 470
3.	Prof. Dr Aanad Joshi,	IIT, Roorkee, email : <a href="mailto:anandfes@iitr.ac.in">anandfes@iitr.ac.in</a>	
4.	Dr S.C. Gupta,	Department of Earth Engineering, IITR, Roorkee, email: <a href="mailto:scgeqfeq@iitr.ac.in">scgeqfeq@iitr.ac.in</a>	
5.	Dr Sumer Chopra,	Institute of seismological Research, Ahmedabad, Gujrat, <a href="mailto:Sumer.chopra@nic.in">Sumer.chopra@nic.in</a>	
1.	Dr Prabash Pandey,	EX DDG, GSI, Engineering geology division, Lucknow	Engineering Geology (ENV 521)
2.	Dr Rejesh Sharma,	Scientist 'G', WIHG , Dehradun, <a href="mailto:sharmarajesh@wihg.res.in">sharmarajesh@wihg.res.in</a>	
3.	Prof Rathinam Anabalgan,	Department of Earth Sciences, IITr, Roorkee email: <a href="mailto:ranbafes@iitr.ac.in">ranbafes@iitr.ac.in</a>	
4.	Dr Ashutosh Kainthola,	NIT Uttarkhand, <a href="mailto:ashukainthola@gmail.com">ashukainthola@gmail.com</a> , <a href="mailto:ashutoshkain@gmail.com">ashutoshkain@gmail.com</a> Mob: 9930238802	
5.	Prof T.N. Singh,	Department of Earth Sciences, IIT Bombay, <a href="mailto:tnsingh@iitb.ac.in">tnsingh@iitb.ac.in</a> ;	
1.	Dr Rejesh Sharma,	Scientist 'G', WIHG , Dehradun, <a href="mailto:sharmarajesh@wihg.res.in">sharmarajesh@wihg.res.in</a>	Himalayan Geology ( ENV 428)
2.	Dr Naresh Dhatwalia,	Scientist C ,WIHG, Dehradun, <a href="mailto:nkd@wihg.res.in">nkd@wihg.res.in</a>	
3.	Dr Gautam Rawat,	Scientist D, WIHG, Dehradun, <a href="mailto:rawatg@wihg.res.in">rawatg@wihg.res.in</a>	
4.	Dr N.K. Meena,	Scientist C, WIHG, Dehradun, <a href="mailto:naren@wihg.res.in">naren@wihg.res.in</a>	
5.	Dr Varun Chaudhary	Scientist 'D', WIHG, Dehradun, <a href="mailto:barun@wihg.res.in">barun@wihg.res.in</a>	

**DR. DEEPAK PANT**

S.No	Name	Address	Papers to be set
1.	Dr Satish Chandra Garkoti	Professor, School of Environmental Sciences, JNU New Delhi E-mail: <a href="mailto:scgarkoti@mail.jnu.ac.in">scgarkoti@mail.jnu.ac.in</a> , <a href="mailto:sgarkoti@yahoo.com">sgarkoti@yahoo.com</a> , Mob: 09871901971	Waste Management (ENV-411)
2.	Dr R K Joshi,	Scientist Department of Science and Technology, Lodhi Road, New Delhi, E Mail : <a href="mailto:rkjoshi.serb@gmail.com">rkjoshi.serb@gmail.com</a> ; 09810194381	
3.	Dr M Uprati,	Chief Scientist, Indian Oil Cooperation (IOC), Indian Oil, R&D Centre, Faridabad, E Mail <a href="mailto:upretim@INDIANOIL.IN">upretim@INDIANOIL.IN</a> ; 09818646104	
4.	Professor R. K. Srivastava	Department of Environmental Sciences, G.B. Pant University of Agriculture and Technology, Pant Nagar, Udham Singh Nagar (Uttarakhand) India, PIN -263145; E mail: <a href="mailto:rajeevsrivastava08@gmail.com">rajeevsrivastava08@gmail.com</a> ; Mob:+91-09997983678, 07500241436	

Amr Singh Chaudhary

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5.	Dr Basant Kumar	Scientist F (retd), Indian Institute of Technology P.O. IIP, MOHKAMPUR, Dehradun, Uttarakhand, E. Mail: basantkumar1952@yahoo.com Phone:0135-2525913; 09410555301	(21) (168)
1.	Dr. Ravindra Khaiwal	Professor, Environmental Health, PGIMER, Chandigarh, Mobile No 8872016262 Email Id: khaiwal@yahoo.com; khaiwal.ravindra@pgimer.edu.in; Tel : 7087008262	Toxic and Hazardous Waste Management (ENV- 523)
2.	Prof T I Khan	Director of the Indira Ghandi Centre for Human Ecology, University of Rajasthan, Jaipur. E mail: tikhan_igc@yahoo.com; Mob: 09829131672, 08626979106	
3.	Dr M Uprati,	Chief Scientist, Indian Oil Cooperation (IOC), IndianOil, R&D Centre, Faridabad, E Mail upretim@INDIANOIL.IN; 09818646104	
4.	Dr Basant Kumar	Scientist F (retd), Indian Institute of Technology P.O. IIP, MOHKAMPUR, Dehradun, Uttarakhand, E. Mail: basantkumar1952@yahoo.com Phone:0135-2525913; 09410555301	
5.	Prof. Vinod Kumar Garg	Centre for Environmental Science and Technology Central University of Punjab, Bathinda 151001, Punjab Phone: +91 9812058109 E mail: vinodkgarg@yahoo.com	
1.	Dr Ganga Bisht	Professor in Chemistry Kumaon University, Nainital; bishtganga@yahoo.com Phone: 09411301225	Analytical Technique (ENV-412)
2.	Dr. Arunabha Datta,	Applied Chemistry, Professor, Centre for Applied Chemistry, Central University of Jharkhand, Brambe Ranchi-835205, E-mail: arunabhadatta18@gmail.com, a_datta50@yahoo.co.in, profadatta@cuja.ac.in	
3.	Dr M Uprati	Chief Scientist, Indian Oil Cooperation (IOC), IndianOil, R&D Centre, Faridabad, E Mail upretim@INDIANOIL.IN; 09818646104	
4.	Dr R K Joshi	, Scientist Department of Science and Technology, Lodhi Road, New Delhi, E Mail : rkjoshi.serb@gmail.com; 09810194381	
5.	Dr Basant Kumar	Scientist F (retd), Indian Institute of Technology P.O. IIP, MOHKAMPUR, Dehradun, Uttarakhand, E. Mail: basantkumar1952@yahoo.com Phone:0135-2525913; 09410555301	

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1.	Dr M Uprati,	Chief Scientist, Indian Oil Cooperation (IOC), IndianOil, R&D Centre, Faridabad, E Mail <a href="mailto:upretim@INDIANOIL.IN">upretim@INDIANOIL.IN</a> ; 09818646104	Carbon Management (ENV- 577)
2.	Dr Naveen Kumar Navani	Associate Professor, Department of Biotechnology, IIT Roorkee (Uttarakhand) E Mail <a href="mailto:navnifbs@iitr.ac.in">navnifbs@iitr.ac.in</a> ; Tel : 0 1332 285677	
3.	Dr Ashwani Kumar	Dr. H.S. Gour Central University; Sagar M P Mobile :07697432012	
4.	Dr. Anupam Sharma	, Geochemistry Scientist-E, Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow - 226007, India. Mob. 09451307713; <a href="mailto:anupam_sharma@bsip.res.in">anupam_sharma@bsip.res.in</a> ; <a href="mailto:anupam110367@yahoo.com">anupam110367@yahoo.com</a> ; <a href="mailto:anupam110367@gmail.com">anupam110367@gmail.com</a>	
5.	Dr K D Joshi	Scientist F, Allahabad Research Centre of CIFRI, Reverine Division 24 Pannalal Road, Allahabad - 211002, UTTAR PRADESH E mail: <a href="mailto:kdjoshi_nrcwrf@rediffmail.com">kdjoshi_nrcwrf@rediffmail.com</a> ; <a href="mailto:kdjoshi.cifri@gmail.com">kdjoshi.cifri@gmail.com</a> ; 09450600926	
	Professor NS Bhandari,	SSJ Campus, Kumaun University, Almora; Q.No.- 2/4, New Professor's Colony, Near Education Faculty, Lower Mall Road Almora- 262501, Uttarakhand INDIA. Tel.: +91-9410501355; 09810501355; Email: <a href="mailto:im_nsbhandari@yahoo.co.in">im_nsbhandari@yahoo.co.in</a>	Environmen tal Chemistry (ENV 403)
	Dr. D.M Joshi	Professor, Department of Chemistry School of Sciences, HNB Garhwal University Srinagar Garhwal 246174 Uttarakhand Email: <a href="mailto:dmjoshi57@gmail.com">dmjoshi57@gmail.com</a> Phone: 09412961264	
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	Dr Basant Kumar,	Scientist F (retd), Indian Institute of Technology P.O. IIP, MOHKAMPUR, Dehradun, Uttarakhand, E. Mail: <a href="mailto:basantkumar1952@yahoo.com">basantkumar1952@yahoo.com</a> Phone:0135- 2525913; 09410555301	
	Dr Geeta Tiwari	Assistant Professor, Department of Chemistry, Kumaon University Nainital, <a href="mailto:geeta_k@rediffmail.com">geeta_k@rediffmail.com</a> ; 09412438823	

DR. MUSHTAQ AHMED

S.No	Name	Address	Papers to be set
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1.	<b>Dr. Ram Sagar</b>	Assistant Professor, Department of Botany, Institute of Science, Banaras Hindu University, Varanasi, Uttar Pradesh-221005; India. Email: sagar@bhu.ac.in & sagarbhu@gmail.com	<p>(213)</p> <p>(164)</p> <p>Fundamentals of Ecology &amp; Environment (ENV434).</p> <p>Environmental Impact Assessment (ENV524).</p> <p>Biodiversity and wildlife Management (ENV408).</p> <p>Environmental Legislations: National and International (ENV-503)</p> <p>Any other paper related to Ecology.</p>
2.	<b>Dr. Harish Chander</b>	Assistant Professor, Department of Botany, Jammu University, Jammu, J & K. Pin: 180006. Email: harishchander@jammuuniveristy.in, hcdutt@rediffmail.com	
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4.	<b>Prof. Abdul Hamid Wani</b>	Professor, Department of Botany, Kashmir University, Hazratbal, Srinagar, Jammu and Kashmir 190006. Email: ahamidwani@yahoo.com	
5.	<b>Dr. A. S. Soodan</b>	Department of Botanical and Environmental Sciences, GNDU, Amritsar	
6.	<b>Prof. Tabreiz Ahmed Khan</b>	Professor, Department of Botany, Aligarh Muslim University, Aligarh, PIN- 202002. Email: tabreizkhan@gmail.com	
1.	<b>Prof. T.R. Sharma,</b>	Professor & Head, Department of Agricultural Biotechnology CSK Himachal Pradesh Agricultural University, Palampur, Distt- Kangra, Himachal Pradesh, India- 176062 Email: <a href="mailto:trsharma@hillagric.ac.in">trsharma@hillagric.ac.in</a> , <a href="mailto:sharmat88@yahoo.com">sharmat88@yahoo.com</a>	<p>Microbial Ecology (ENV550)</p> <p>Environmental Microbiology (ENV409).</p>
2.	<b>Dr. Harish Chander</b>	Assistant Professor, Department of Botany, Jammu University, Jammu, J & K. Pin: 180006. Email: harishchander@jammuuniveristy.in, hcdutt@rediffmail.com	
3.	<b>Prof. Tabreiz Ahmed Khan</b>	Professor, Department of Botany, Aligarh Muslim University, Aligarh, PIN- 202002. Email: tabreizkhan@gmail.com	
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5.	<b>Prof. Abdul Hamid Wani</b>	Professor, Department of Botany, Kashmir University, Hazratbal, Srinagar, Jammu and Kashmir 190006. Email: ahamidwani@yahoo.com	

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S.No	Name	Address	Papers to be set

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2	Prof. A. P. Dimri	School of Environmental Sciences, Jawaharlal Nehru University, New Delhi – 110067 <a href="mailto:apdimri@jnu.ac.in">apdimri@jnu.ac.in</a> 011-26704319	
3	Dr. J. C. Kuniyal	Scientist – F, G.B.P.I.H.E.D., Himachal Unit, Mohal-Kullu, Himachal Pradesh, India <a href="mailto:jckuniyal@rediffmail.com">jckuniyal@rediffmail.com</a> +91-9418154941	
4	Dr. Amit Prakash	Assistant Professor Dept. of Environmental Science Tezpur University Napaam, Dist. - Sonitpur, Assam – 784028 <a href="mailto:amitprakash.amit@gmail.com">amitprakash.amit@gmail.com</a> ; <a href="mailto:ap@tezu.ernet.in">ap@tezu.ernet.in</a> +91 - 3712-275616; 8473881772	
5	Dr. Ujjwal Kumar	Assistant Professor School of Environment & Natural Resource, Doon University, Dehradun <a href="mailto:ukumar.senr@doonuniversity.ac.in">ukumar.senr@doonuniversity.ac.in</a> ; <a href="mailto:ujjwalkumarin@yahoo.co.in">ujjwalkumarin@yahoo.co.in</a> +91-9999180839	
6	Dr. Arun Srivastava	School of Environmental Sciences, Jawaharlal Nehru University, New Delhi – 110 067, India <a href="mailto:a_srivastava@mail.jnu.ac.in">a_srivastava@mail.jnu.ac.in</a> , <a href="mailto:srivastava02@hotmail.com">srivastava02@hotmail.com</a> +91-11-2673 8706 (O), 98680 88440 (M)	
7	Dr. Dinesh Kumar	Department of Environmental Science Central University of Jammu Bagla-Rahya Sychani, Samba, Jammu and Kashmir, 181143 <a href="mailto:dineshynu2020@gmail.com">dineshynu2020@gmail.com</a>	
	Prof. A. K. Thukral	Dept. of Botanical & Environment Sciences, Guru Nanak Dev University, Amritsar-143005, Punjab, India	Introduction to Statistical Techniques (ENV – 432)
	Prof. Anil K. Raina	Department of Environmental Sciences, University of Jammu, Babasahib Ambedkar Road, Jammu, J&K - 180006, [India]	
1	Dr. Pratap Kumar Padhy	Associate Professor & Head Department of Environmental Studies Siksha Bhavna Viswa-Bharati Santiniketan-731235 Birbhum (West Bengal) <a href="mailto:pkpadhy@visva-bharati.ac.in">pkpadhy@visva-bharati.ac.in</a> , <a href="mailto:padhykp@gmail.com">padhykp@gmail.com</a>	Atmospheric Science (ENV – 516)
2	Dr. S. Balachandran	Assistant Professor Department of Environmental Studies Siksha Bhavna, Visva-Bharati	Environmental Engineering (ENV- 537)
			Atmospheric

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3	Prof. U. C. Kulshrestha	School of Environmental Sciences Jawaharlal Nehru University New Delhi 110 067 INDIA Email: <u>umeshkulshrestha@gmail.com</u> , <u>umesh@mail.jnu.ac.in</u> Tel: 011 26704320; 9810611857		
4	Dr. Shweta Yadav	Department of Environmental Science Central University of Jammu Bagla-Rahya Sychani, Samba, Jammu and Kashmir, 181143 <u>shwetayadav.jnu@gmail.com</u> +91-94199-26579		
5	Dr. Sudesh Yadav	School of Environmental Sciences, Jawaharlal Nehru University, New Delhi – 110067 <u>sudesh27@hotmail.com</u> +91-99680-77736; +11-2670-4197		
6	Dr. M. S. Bhatti	Associate Professor Dept. of Botanical & Environment Sciences, Guru Nanak Dev University, Amritsar-143005, Punjab, India <u>mbhatti73@gmail.com</u> ; <u>mbhatti.dobes@gndu.ac.in</u> +91-9417107598		Environment al Engineering (ENV 537) Environment al Chemistry (ENV 403)
1	Dr. Umesh Kumar Singh	Assistant Professor of Environmental Science, Integrated Science Education and Research Centre (ISERC), Siksha Bhavana (Institute for Science), Visva-Bharati University, Santiniketan-731235, West Bengal, INDIA 09475216878		
2	Dr. Rakesh Kumar Atri	Assistant Professor Department of Environmental Sciences, University of Jammu, Babasahib Ambedkar Road, Jammu, J&K - 180006, [India] <u>rakeshkumaratri@gmail.com</u> 9419174941		Environment al Engineering (ENV 537) Environment al Geochemistr y (ENV 525) Environment al Chemistry (ENV 403)
3	Dr. Rajesh Ranjan	Assistant Professor Centre for Environmental Sciences, Central University of South Bihar Vinova Nagar, Chandauti, PS : Magadh Medical College, Ward No. 29, Gaya – 823001, Bihar <u>rajesh.ranjan@cub.ac.in</u> ; <u>rajeshkranjan@gmail.com</u> 08969933690		
4	Dr. Alok Kumar	Assistant Professor Department of Environmental Science, Central University of Rajasthan, NH-8, Bandar Sindri, Ajmer-305817, Rajasthan <u>alok evs@curaj.ac.in</u>		

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5	Dr. Anupam Sharma	Birbal Sahni Institute of Palaeosciences, 53 University Road , Lucknow – 226007 <a href="mailto:anupam110367@gmail.com">anupam110367@gmail.com</a> 9451307713	Environmental Geochemistry (ENV 525)	

DR. S. CHATTERJEE

S.No	Name	Address	Papers to be set
1.	Prof. Shibani Chaudhary	Department of Environmental Studies Siksha Bhavna Viswa-Bharati Santiniketan-731235 Birbhum (West Bengal) <a href="mailto:shibani.chaudhury@visva-bharati.ac.in">shibani.chaudhury@visva-bharati.ac.in</a>	ENV 569: Environmental Pollution and Health Issues
2.	Dr. S. Balachandran	Department of Environmental Studies Siksha Bhavana, Visva-Bharati Santiniketan – 731235 <a href="mailto:s.balachandran@visva-bharati.ac.in">s.balachandran@visva-bharati.ac.in</a> +91-9531535710	
3.	Dr. Subrata Ghosh	School of Basic Sciences IIT Mandi, PWD Rest House 2nd floor, 91-9459527580 <a href="mailto:subrata@iitmandi.ac.in">subrata@iitmandi.ac.in</a> ; <a href="mailto:subuch@gmail.com">subuch@gmail.com</a>	
4.	Dr. J R GAYEN	Scientist Pharmacokinetics & Metabolism Division Assistant Professor AcSIR Pre-Clinical North Block, Lab # 104 CSIR- Central Drug Research Institute Sitapur Road, Lucknow - 226031 India 91-8874201999 <a href="mailto:jr.gayen@cdri.res.in">jr.gayen@cdri.res.in</a>	
5.	Dr. Shweta Yadav	Assistant Professor Department of Environmental Science Central University of Jammu Bagla Rahya-Suchani, Samba Jammu & Kashmir – 181143 <a href="mailto:Shwetayadav.jnu@gmail.com">Shwetayadav.jnu@gmail.com</a> +91-94199-26579	
1.	Prof. Arun K. Attri	School of Environmental Sciences Jawaharlal Nehru University New Delhi – 11067 <a href="mailto:attriak@gmail.com">attriak@gmail.com</a> +91-9560461930	ENV 574: Bio-Analytical Techniques
2.	Dr. Bomba Dam	Assistant Professor of Microbiology, Department of Botany, Siksha Bhavana, Visva-Bharati, Santiniketan – 731235, WB <a href="mailto:bumba_micro@visva-bharati.ac.in">bumba_micro@visva-bharati.ac.in</a> ; <a href="mailto:bumba_micro@rediffmail.com">bumba_micro@rediffmail.com</a> +91-3463-262751-6 (6 lines) Ext. 382 (O), +91-9475444801 (M)	
3.	Prof. Kasturi Mukhopadhyaya	School of Environmental Sciences Jawaharlal Nehru University	

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1.	Prof. Subrata Sau	Department of Biochemistry Bose Institute centenary building, P-1/12 C.I.T. Scheme VII M; Kolkata-700 054, India Phone: +91-33-2569-3228 Fax: +91-33-2355-3886 E-Mail: <a href="mailto:sau@bic.boseinst.ernet.in">sau@bic.boseinst.ernet.in</a>		
2.	Dr. Surajit Bhattacharjee	Assistant Professor, Department of Molecular Biology and Bioinformatics, Tripura University (A Central University), Agartala, Tripura, Ph. No- <a href="tel:08974984569">08974984569</a> <a href="mailto:sbhattacharjee@gmail.com">sbhattacharjee@gmail.com</a>		ENV 578: Recent Trends in Environmental Biotechnology
3.	Prof. S.S. Kanwar,	Head, Department of Microbiology, Director of Research CSK Himachal Pradesh Agricultural University, Palampur, HP <a href="mailto:sskanwar1956@gmail.com">sskanwar1956@gmail.com</a> 91-1894-230406; 91-9418093256		
4.	Prof. T. R. Sharma	Department of Agricultural Biotechnology CSK HP Agricultural University, Palampur-176 062 INDIA Cell: 91-9418057601 Email: <a href="mailto:trsharma88@gmail.com">trsharma88@gmail.com</a>		
5.	Prof. Pawan Dhar	School of Biotechnology Jawaharlal Nehru University New Delhi – 11067 <a href="mailto:pawandhar@mail.jnu.ac.in">pawandhar@mail.jnu.ac.in</a> <a href="mailto:pkd.jnu@outlook.com">pkd.jnu@outlook.com</a>		
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1.	Dr. Abhik Saha	Department of Biotechnology Presidency University, Kolkata - 700073, WB Ph- 91-9874924838 Email: <u>abhik.biotechnology@presiuniv.ac.in</u> ; <u>abhik_sus@yahoo.com</u>		ENV 557: Bio- resources and Environment al Biotechnolog y
2.	Prof. Shamsheer Singh Kanwar	Department of Biotechnology Himachal Pradesh University Shimla-171005 Ph- 9418085397 Email: <u>kanwarss2000@yahoo.com</u>		
3.	Dr. N. Mathivanan	Director and Head, Centre for Advanced Studies in Botany University of Madras Maraimalai Campus Guindy, Chennai – 600025 Ph- +91-44-22202762 Email: <u>prabhamathi@unom.ac.in</u> ; <u>prabhamathi@yahoo.com</u>		
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2.	Dr. Rakesh Kumar Ranjan	Department of Geology, School of Physical Sciences, Sikkim University, Dara Gaon, Tadong, Gangtok, Sikkim - <u>737102geology@cus.ac.in</u> <u>rakeshranjan.jnu@gmail.com</u>	
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2.	Dr. Shweta Yadav	Department of Environmental Sciences Rahya Suchani, Samba District, Bagla, Jammu and Kashmir 181143 <a href="mailto:shwetayadav.jnu@gmail.com">shwetayadav.jnu@gmail.com</a>		
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2.	Dr. Chander Kumar Singh	Department of Regional Water Studies, TERI University, Plot No. 10 Institutional Area, Vasant Kunj, New Delhi - 110 070 <a href="mailto:chander.singh@teriuniversity.ac.in">chander.singh@teriuniversity.ac.in</a> <a href="mailto:chanderkumarsingh@gmail.com">chanderkumarsingh@gmail.com</a>		
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5.	Dr. Amit Prakash	Department of Environmental Science Assam Tezpur University, Napaam, Sonitpur, Assam-784 028 <a href="mailto:amitprakash.amit@gmail.com">amitprakash.amit@gmail.com</a>		
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2.	Dr. Shruti	Amity School of Earth and Environmental Sciences, Amity Education Valley, Gurgaon (Manesar) – 122 413, Haryana <a href="mailto:sakshishruti@gmail.com">sakshishruti@gmail.com</a>		

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3.	Dr. Pottakkal George Jose	National Institute of Hydrology, Western Himalayan Regional Centre, Satwari, Opp. Military Hospital, Jammu Cantt - 180 003 (J & K) jose.pottakkal@gmail.com	Natural Resource Conservation
4.	Dr. Alok Kumar	Department of Environmental Science, Central University of Rajasthan, NH-8, Bandar Sindri, Ajmer-305817, Rajasthan alok_evs@curaj.ac.in	
5.	Dr. Ranveer Singh	Department of Sociology and Social Work Rahya Suchani, Samba District, Bagla, Jammu and Kashmir 181143 ranvir.jnu@gmail.com	
1.	Dr. Pottakkal George Jose	National Institute of Hydrology, Western Himalayan Regional Centre, Satwari, Opp. Military Hospital, Jammu Cantt - 180 003 (J & K) jose.pottakkal@gmail.com	ENV 578 – Introduction to Glaciology
2.	Dr. Shruti	Amity School of Earth and Environmental Sciences, Amity Education Valley, Gurgaon (Manesar) – 122 413, Haryana sakshishruti@gmail.com	
3.	Dr. Parmanand Sharma	National Centre for Antarctic and Ocean Research, Ministry of Earth Sciences, Government of India, Headland Sada, Vasco-da-Gama, Goa 403 804 pnsharma@ncaor.gov.in	
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1.	Dr. Pottakkal George Jose	National Institute of Hydrology, Western Himalayan Regional Centre, Satwari, Opp. Military Hospital, Jammu Cantt - 180 003 (J & K) jose.pottakkal@gmail.com	ENV 579 – Recent Trends in Glaciology
2.	Dr. Shruti	Amity School of Earth and Environmental Sciences, Amity Education Valley, Gurgaon (Manesar) – 122 413, Haryana sakshishruti@gmail.com	
3.	Dr. Parmanand Sharma	National Centre for Antarctic and Ocean Research, Ministry of Earth Sciences, Government of India, Headland Sada, Vasco-da-Gama, Goa 403 804 pnsharma@ncaor.gov.in	
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2.	Dr. Shruti	Amity School of Earth and Environmental Sciences, Amity Education Valley, Gurgaon (Manesar) – 122 413, Haryana sakshishruti@gmail.com	
3.	Dr. Alok Kumar	Department of Environmental Science, Central University of Rajasthan, NH-8, Bandar Sindri, Ajmer-305817, Rajasthan alok_evs@curaj.ac.in	
4.	Dr. Chander Kumar Singh	Department of Regional Water Studies, TERI University, Plot No. 10 Institutional Area, Vasant Kunj, New Delhi - 110 070 chander.singh@teriuniversity.ac.in chanderkumarsingh@gmail.com	
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2.	Prof. S. Chauhan	Professor, Department of Chemistry, Himachal Pradesh University, Shimla-5, India. Email: <a href="mailto:scschauhan19@gmail.com">scschauhan19@gmail.com</a> Mobile: 9418001803	
3.	Prof. S.K Mehta	Professor, Department of Chemistry, Panjab University, Chandigarh-160014, India. Email: <a href="mailto:skmehta@pu.ac.in">skmehta@pu.ac.in</a> Mobile: 9417786061	
4.	Prof. S.K. Lomesh	Professor, Department of Chemistry, Himachal Pradesh University, Shimla-5, India. Email: <a href="mailto:drsklomesh@gamil.com">drsklomesh@gamil.com</a> Mobile: 9418382396	
5.	Prof. A.K Ganguly	Professor, Department of Chemistry, Indian Institute of Technology, Delhi, Hauz Khas, New Delhi-110016, India Tel: +91-11-26591511 (Of fice) +91-11-26596452 (Lab) Email: <a href="mailto:ashok@chemistry.iitd.ac.in">ashok@chemistry.iitd.ac.in</a>	
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2.	Dr. Virender Kaur	Assistant Professor, Department of Chemistry, Panjab University, Chandigarh-160014, India. Email: <a href="mailto:var_ka04@pu.ac.in">var_ka04@pu.ac.in</a> Mobile: 9872313583	
3.	Dr. M.S. Thakur	Associate Professor, Department of Chemistry, Himachal Pradesh University, Shimla-5, India	
			Green Chemistry and Environment (ENV 530).

		Email: <a href="mailto:drmahender74@gmail.com">drmahender74@gmail.com</a> Mobile: 9218501496	<div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">222</div> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">498</div>
4.	Dr. Ganga Ram	Associate Professor, Department of Chemistry, Panjab University, Chandigarh-160014, India. Email: <a href="mailto:grc22@pu.ac.in">grc22@pu.ac.in</a> Mobile: 9878822323	
5.	Dr. Neeraj Gupta	Associate Professor, Department of Chemistry, Shoolini University, Solan. Email: <a href="mailto:gupta_nrj@gmail.com">gupta_nrj@gmail.com</a> Mobile: 8894211891	

The BOS discussed and approved the list as duly signed and submitted by the concerned teachers as reproduced in the Table 3 above. It was further resolved that if a teacher teaching a course is not available due to any reason for a Semester to teach the course and the course he/she was teaching will be naturally taught by some other teacher. In that case the instant teacher teaching that course may send additional names of paper setters for the course to the Controller of Examination through Dean / HoD.

**ITEM NO: ENV-BOS-6/15-5**

To approve the updated list of External Examiners for conducting practical Examinations / Dissertations and Viva-Voce for the Department of Environmental Sciences

(Annexure-I).

The BOS discussed the updated list of External Examiners for conducting practical Examinations / Dissertations and Viva-Voce and approved the same.

**ITEM NO: ENV-BOS-6/15-6**

To approve the names of Co-supervisors for the following RD scholars (working under the Supervision of Dr. S. Chatterjee in the Department of Environmental Sciences, CUHP). Request letter is placed as (Annexure –II).

**Table 4:**

S.No.	Enrolment No.	Name of the candidate	Co-Supervisor
1.	CUHP13RDENV03	Miss. Madhulika Kushwaha	Dr. Dharam Singh, Senior Scientist, Biotechnology Division, IHBT, Palampur.
2.	CUHP15RDENV05	Miss. Shalini Verma	Dr. Dharam Singh, Senior Scientist, Biotechnology Division, IHBT, Palampur.

The BOS discussed and approved the proposal as given above in table 4.

**ITEM NO: ENV-BOS-6/15-7**

To report to the BOS the consent of letter of Dr. Anurag Linda, Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh to act as Co-supervisor of Miss. Riju

*(Signatures)*

Parmar, registered for Ph.D degree (Enrolment No. 2016-E2-112) under the supervision of Prof. H.P. Singh, in the Department of Environmental Studies, Panjab University, Chandigarh. Request letter for the same is placed as (Annexure-III). (2k<sup>3</sup>)  
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The BOS discussed the proposal and decided that the Department of Environmental Sciences, Central University of Himachal Pradesh has no objection if Dr. Anurag Linda, Assistant Professor, is appointed by the Panjab University, Chandigarh as Co-supervisor of Miss. Riju Parmar, registered for Ph.D degree (Enrolment No. 2016-E2-112) under the supervision of Prof. H.P. Singh, in the Department of Environmental Studies, Panjab University. However, on getting appointed as Co-Supervisor, he will inform the HoD/Dean, Department of Environmental Sciences, Central University of Himachal Pradesh for reporting to the BOS in its next meeting.

ITEM NO: ENV-BOS-6/15-8


To focus on research and teaching in Waste management as an emerging area in the light of Swachh Bharat Mission.

The members agreed and suggested that following sub areas of teaching and research should be focused


- Modern and Scientific Waste Management
- Biomedical waste management
- Public and occupational health
- Management engineering
- Healthy sanitation practices
- Capacity building in waste management

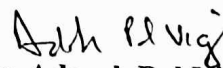
THE MEETING ENDED WITH A VOTE OF THANKS TO THE CHAIRMAN

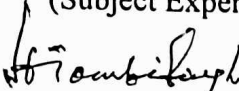
  
Dr. Ankit Tandon  
(Member)


  
Dr. Mushtaq Ahmed  
(Member)

  
Prof. Ambrish R. Mahajan  
(Member)

  
Dr. Vikram Singh  
(VC Nominee)

  
Dr. Adarsh Pal Vig  
(Subject Expert)

  
Prof. H. Tombi Singh  
(Subject Expert)

  
Dr. Deepak Pant  
(Chairman and Convener)

हिमाचल प्रदेश केंद्रीय विश्वविद्यालय  
**Central University of Himachal Pradesh**

(Established under Central Universities Act 2009)

Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

(Shahpur Campus, Shahpur, Kangra, Himachal Pradesh, India - 176206)



**MINUTES**

**TENTH MEETING OF THE BOARD OF STUDIES  
OF THE DEPARTMENT OF ENVIRONMENTAL SCIENCES  
HELD ON 25<sup>TH</sup> SEPTEMBER, 2021 AT 11.45 AM onwards.**

**Venue: ONLINE - GOOGLE MEET**



## हिमाचल प्रदेश केंद्रीय विश्वविद्यालय Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

(Shahpur Campus, Shahpur, Kangra, Himachal Pradesh, India - 176206)

File No. EES/1-5 (Vol.II)/CUHP/....

Dated: 25<sup>th</sup> September, 2021

### MINUTES

The 10<sup>th</sup> meeting of the Board of Studies (BOS) of the Department of Environmental Sciences was held Online on 25<sup>th</sup> September, 2021 at 11.45 AM onwards on Google Meet platform. The following members/invitees attended the meeting:

1.	<b>Prof. Deepak Pant</b> , Professor & Head, Department of Environmental Sciences, Dean, School of Earth and Environmental Sciences	CONVENER & CHAIRMAN
2.	<b>Prof. AL. Ramanathan</b> , School of Environmental Sciences, Jawaharlal Nehru University, New Delhi - 110067	SUBJECT EXPERT
3.	<b>Prof. Desh Raj Thakur</b> , Department of Bio Sciences, Himachal Pradesh University, Shimla-171005	SUBJECT EXPERT
4.	<b>Prof. A. K. Mahajan</b> , Professor, Department of Environmental Sciences, Central University of Himachal Pradesh	MEMBER
5.	<b>Prof. O.S.K.S. Sastri</b> , Professor, School of Physical and Material Sciences, Central University of Himachal Pradesh.	MEMBER (VC NOMINEE)
6.	<b>Dr. Vikram Singh</b> , Assistant Professor, Centre for Computational Biology & Bioinformatics, School of Life Sciences, Central University of Himachal Pradesh.	MEMBER (VC NOMINEE)
7.	<b>Dr. Ankit Tandon</b> Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	SPECIAL INVITEE
8.	<b>Dr. Subhankar Chatterjee</b> , Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	SPECIAL INVITEE
9.	<b>Dr. Dilbag Singh</b> Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	SPECIAL INVITEE

The following members could not attend the meeting:

1.	<b>Dr. Anurag Linda</b> Assistant Professor, Department of Environmental Sciences, Central University of Himachal Pradesh.	MEMBER
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Prof. Deepak Pant, Dean, School of Earth and Environmental Sciences (Convener & Chairman of the BOS) welcomed all the members and thanked them for being available and for attending the meeting.



**THEREAFTER, THE AGENDA ITEMS WERE TAKEN UP AS UNDER:**

**Agenda Items:**

**ITEM NO: ENV-BOS-10/21-1:** *Confirmation of the Minutes of the 9<sup>th</sup> Meeting of the Board of Studies held on 7<sup>th</sup> July, 2020.*

**The BoS confirmed the Minutes of the 9th Meeting of the Board of Studies held on 7th July, 2020.(Annexure-I)**

**ITEM NO: ENV-BOS-10/21-2:** *To place before the BoS for its approval, a revised structure the M.Sc. Environmental Science programme in the light of New Education Policy-2020. All the revisions made, time to time, in the syllabus of different courses of the M.Sc. Environmental Science programme as per the NEP-2020 guidelines will be reported to the upcoming BOS meetings.*

**The BoS approved the revised structure the M.Sc. Environmental Science programme in the light of New Education Policy-2020.(Annexure-II)**

**ITEM NO: ENV-BOS-10/21-3:** *To place before the BoS for its approval Adoption of Blended mode of learning in MSc Environmental Science programme and course work of PhD Environmental Science programme in the light of New Education Policy-2020.*

**The BoS approved the Adoption of Blended mode of learning in MSc Environmental Science programme and course work of PhD Environmental Science programme in the light of New Education Policy-2020.**

**ITEM NO: ENV-BOS-10/21-4:** *To place before the BoS for its approval Adoption of Multiple Entry-Exit system in MSc Environmental Science programme in the light of New Education Policy-2020.*

**The BoS approved the Adoption of Multiple Entry-Exit system in MSc Environmental Science programme in the light of New Education Policy-2020.**

**ITEM NO: ENV-BOS-10/21-5:** *To place before the BoS for its approval, the list of new courses to be introduced in the proposed revised structure of the MSc Environmental Science programme as per NEP-2020.*

**The BoS approved the list of new courses to be introduced in the proposed revised structure of the MSc Environmental Science programme as per NEP-2020.(Annexure-III)**

**ITEM NO: ENV-BOS-10/21-6:** *To place before the BoS for its approval, the list of Supervisor and Co-supervisors allotted to the following Research Degree Students admitted for Ph.D. degree programme in the session 2020-2021.*



BoS approved the allotment of Supervisor and Co-supervisors to the following Research Degree Students admitted to Ph.D. degree programme in the session 2020-2021 as follows:

Sr. No.	Registration No.	Students Name	Supervisor Allotted	Co-Supervisor Allotted
1.	CUHP20RDENV01	Akshay	Dr.Dilbag Singh	
2.	CUHP20RDENV03	Dharneshwari Sharma	Prof.A.K.Mahajan	
3.	CUHP20RDENV04	KomalKundal	Prof.A.K.Mahajan	
4.	CUHP20RDENV04	Priyanka	Prof.A.K.Mahajan	
5.	CUHP20RDENV06	Priyanka Chaudhary	Dr.Subhankar Chatterjee	
6.	CUHP20RDENV07	RichaPanjla	Prof.A.K.Mahajan	Dr. Sanjay Panday, Scientist, Central Ground Water Board, Ministry of Jal Shakti, Govt. of India, Dharmshala, H.P
7.	CUHP20RDENV08	Ritika Sharma	Dr.Dilbag Singh	
8.	CUHP20RDENV09	Sunidhi	Dr.SubhankarChatterjee	

In the case of Mr. Deepak Sharma (CUHP20RDENV02), the following facts have come to the notice of the BoS members regarding allocation of supervisor.

1. Statement received by the then head and dean of the department and school was received and recorded as **Annexure A**.
2. Statement received from Dr Pankaj Thakur former Associate Professor (Leave vacancy), Department of Environmental Sciences, Central University of Himachal Pradesh, Dharamshala (Currently Associate Professor, Jawaharlal Nehru University) as **Annexure B**.

#### DISCUSSION AND RESULATION

Based on the expertise of Dr Dilbag Singh, an Assistant Professor in the Department of Environmental Sciences, Central University of Himachal Pradesh will be the prospective supervisor of Mr Deepak Sharma (CUHP20RDENV02). The BoS further took the advice of Dr.Dilbag Singh regarding the fact: Even though Dr.Dilbag Singh gave his consent for supervising Mr Deepak Sharma in front of all the BOS members in the interest of student, but he has submitted that he already has exhausted his maximum number (04) of PhD students as per the UGC guideline.

*It was finally resolved from the members that the candidate (Mr Deepak Sharma) can be permitted to do his research with Dr Dilbag Singh subject to the supernumerary PhD seat permission to him from the competent authority and accordingly he will make further association with Dr Pankaj Thakur as per the rules.*

**Annexure A**



25/09/2021, 08:21

Yahoo Mail - Re: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

Re: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

From: Ambrish Mahajan (akmahajan@rediffmail.com)  
To: dpant2003@yahoo.com; rajeev025singh@gmail.com  
Cc: dilbagrana@gmail.com; thakurpankaj535@gmail.com  
Date: Thursday, 23 September, 2021, 05:50 pm IST

Dear Dr Pant

Mr Deepak has joined as research scholar after getting recommendations from Dr Pankaj Thakur, who was faculty of the department (on lien)at that time. However Dr Pankaj Thakur was relieved from university on his selection in JNU as Associate Professor. Dr Pankaj was an expert in Nano Technology and we have similar expertise available is Dr Dilbag Singh. so keeping in view the interest of student and his field of interest shown at the time of his admission. I recommend that Mr Deepak Sharma may kindly be allot to Dr Dilbag Singh with co supervision of Dr Pankaj Thakur.

Regards  
Prof. A.K. Mahajan  
Professor, ENV

From: rajeev singh <rajeev025singh@gmail.com>  
Sent: Thu, 23 Sep 2021 17:27:38 GMT+0530  
To: Ambrish Mahajan <akmahajan@rediffmail.com>  
Subject: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

आदरणीय महोदय

मैं पर्यावरण विज्ञान विभाग के विभागाध्यक्ष के आदेशानुसार लिख रहा हूँ कि संकलित ईमेल प्राप्त करें कि

केंद्रीय विश्वविद्यालय हिमाचल प्रदेश के पर्यावरण विज्ञान विभाग के शोध छात्र श्री दीपक शर्मा से डॉ. पंकज ठाकुर के हस्ताक्षर के साथ प्रार्थना पत्र प्राप्त हुआ है। दीपक शर्मा का पी. एच. डी. में दाखिला आपके पर्यावरण विज्ञान विभाग में अधिष्ठाता तथा विभागाध्यक्ष कार्यकाल में हुआ था अतः : आपसे विनम्र अनुरोध है कि दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्ति के बारे में अपनी राय (Remarks) प्रदान करने की कृपा करें।

धन्यवाद

सादर

राजीव सिंह  
डाटा एंटी ऑपरेटर  
पर्यावरण विज्ञान विभाग  
contact no. 9805202021





25/09/2021, 08:23

Yahoo Mail - Fwd: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

Fwd: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

From: rajeev singh (rajeev025singh@gmail.com)

To: dpant2003@yahoo.com

Date: Friday, 24 September, 2021, 05:41 pm IST

----- Forwarded message -----

From: Pankaj Thakur <chempank@gmail.com>

Date: Fri, Sep 24, 2021 at 4:50 AM

Subject: Re: दीपक शर्मा शोध छात्र पर्यावरण विज्ञान विभाग के पर्यवेक्षक नियुक्त करने के सम्बन्ध में।

To: rajeev singh <rajeev025singh@gmail.com>

Cc: <registrar@hcu.ac.in>

Dear Rajeev Ji,

As per the information sought in your trailing email, please see below my responses:

1. I give my full consent with reference to the facts and requests presented in the application of Mr Deepak Sharma (PhD student) which I got in your trailing mail.
2. As I consented affirmatively to continue guiding Mr Deepak Sharma, I am seeking an NOC from my present University/Department. Also, because of strict Covid protocols here, it may take some time!
3. Since you have put forth the Ordinance 42 of the CUHP, therefore I intend to consult/request a few of the present Faculty members of the CUHP keeping in mind the common research interests and their availability as well.

Thanks

On Thu, Sep 23, 2021 at 5:16 PM rajeev singh <rajeev025singh@gmail.com> wrote:

आदरणीय महोदय

मैं पर्यावरण विज्ञान विभाग के विभागाध्यक्ष के आदेशानुसार लिख रहा हूँ कि संकलित ईमेल प्राप्त करें तथा इसी प्रार्थना पत्र के सम्बन्ध में कुछ महत्वपूर्ण तथ्य प्रस्तुत हैं:-

- (1) केंद्रीय विश्वविद्यालय हिमाचल प्रदेश के पर्यावरण विज्ञान विभाग के शोध छात्र श्री दीपक शर्मा से आपके हस्ताक्षर सहित प्रार्थना पत्र प्राप्त हुआ है जो कि इस ईमेल में संलग्नित है क्या आप इसके सम्बन्ध में सहमत हैं।
- (2) यदि आप सहमत हैं तो कृपया अपने विश्वविद्यालय / विभाग निम्नमें आप अभी कार्यरत हैं उनसे एक अनापत्ति (NOC) प्रमाण पत्र केंद्रीय विश्वविद्यालय हिमाचल प्रदेश के पर्यावरण विज्ञान विभाग को देने की कृपा करें।
- (3) केंद्रीय विश्वविद्यालय हिमाचल प्रदेश के अध्यादेश 42 के अनुसार पर्यवेक्षक अपने विश्वविद्यालय का ही होना चाहिये। किसी दूसरे संस्थान / विश्वविद्यालय के विषय एक्सपर्ट को सह पर्यवेक्षक ही नियुक्त किया जा सकता है इसलिए आपसे अनुरोध है कि केंद्रीय विश्वविद्यालय हिमाचल प्रदेश के पर्यावरण विज्ञान विभाग में से किसी को दीपक शर्मा का पर्यवेक्षक नियुक्त होने की सहमति प्रदान करवाएं तभी आपको सह पर्यवेक्षक नियुक्त किया जा सके।

धन्यवाद

सादर

राजीव सिंह

डाटा एंट्री ऑफ़िसर

पर्यावरण विज्ञान विभाग



THE MEETING ENDED WITH A VOTE OF THANKS TO THE CHAIR.

*(Signature)*

(Dr. Dilbag Singh)

*(Signature)*

(Dr. Ankit Tandon)

Approved through Email

(Prof. O.S.K.S. Sastri)

*(Signature)*

Approved through Email

(Prof. Desh Raj Thakur)

*(Signature)*

(Dr. Subhankar Chatterjee)

Approved through Email  
(Dr. Vikram Singh)

Approved through Email

(Prof. A. K. Mahajan)

Approved through Email

(Prof. AL. Ramanathan)

Prof. Deepak Pant)

~~Chairman and Convener~~

Head, Department of Environmental Sciences  
हिमाचल प्रदेश केंद्रीय विश्वविद्यालय  
Central University of Himachal Pradesh  
अस्थायी शैक्षणिक ब्लॉक/Temporary Academic Block  
शाहपुर, कांगड़ा (हि.प्र.)/Shahpur, Kangra (H.P.)-176206

Annexure-1

10<sup>th</sup> Bos

Implementation of CBCS under NEP Guidelines

1st Semester:			
Course Type	Course Code	Course Name	Credits
Major Courses	ENV 401	Introduction to Ecology	2
	ENV 402a	Introduction to Earth Processes	2
	ENV 403	Environmental Chemistry	4
	ENV 445	Environmental Chemistry Laboratory	2
	ENV 501	Environmental Pollution and Human Health	2
	ENV 516	Atmospheric Science	2
Vocational / Skill	ENV 411	Waste Management	2
Interdisciplinary course offered to other department (Minor Course)	ENV 443	Basics of climate change	2
	ENV 508	Environmental Ethics	2
Indigenous Knowledge System	ENV 449	Indigenous Knowledge System	2
2nd Semester:			
Course Type	Course Code	Course Name	Credits
Major Courses	ENV 424	Fundamentals of Remote Sensing	2
	ENV 428	Himalayan Geology	2
	ENV 432	Introduction to Statistical Techniques	4
	ENV 444	Environmental Geo Science Lab	2
	ENV447	Computational Statistical Analysis Laboratory	2
	ENV 577	Carbon Management	2
Interdisciplinary course offered to other department (Minor Course)	ENV 408	Biodiversity and wild life management	2
	ENV 547	Contemporary environmental issues	2
Vocational / Skill	ENV 524	Environmental impact Assessment	2
Indigenous Knowledge System	ENV 441	Water Resource Conservation in Hilly Region	2

Anup Singh 15/11/2021
   
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 Anshu Kumar 13/12/2021
   
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Annexure – II

ENROLLMENT NO.	OLD TOPIC	REVISED TOPIC
CUHP17RDENV02	Studies on long-term variations in rainfall characteristics over Indian regions	Studies on Long-term Variations in Rainfall Characteristics over Indian Subcontinent
CUHP17RDENV09	Study of mass closure and source apportionment of PM <sub>2.5</sub> aerosol over Jammu, India	Studies of Mass Closure and Source Apportionment of PM <sub>2.5</sub> Aerosol In Jammu City of J&K (UT) India
CUHP20RDENV04	Site Characterization of Kathua city of Kathua district, J&K, India using geophysical approaches for the upper 30 m depth	Site characterization using geophysical approaches for upper 30m soil column of Kathua city of J&K (UT) India
CUHP20RDENV03	Seismic Hazard Analysis of North-West Himalaya with Special Reference to Reasi District (Reasi-Katra Belt) of Jammu Province, J&K, India.	Seismic Hazard Analysis of North-West Himalaya with Special Reference to Reasi-Katra Belt of J&K (UT), India
CUHP20RDENV07	Hydro-chemical assessment of Groundwater, Springwater, and major water supply drains around Jawalamukhi town, District Kangra, North-West Himalaya	Hydro-chemical assessment of Groundwater, Spring water, and Surface water around Jawalamukhi, District Kangra, Himachal Pradesh
CUHP20RDENV05	Site amplification study of Mohali city using Geophysical and Geotechnical approaches.	Studies on the site amplification of Mohali city by using Geophysical and Geotechnical approaches
CUHP18RDENV01	Studies on Ozone dynamics over Indian region	Studies on the Ozone Dynamics over Indian Subcontinent
CUHP17RDENV12	Assessment of Hydro Geochemical Status of Springs of Dharamshala and Kangra Block, Himachal Pradesh	Assessment of Hydro Geochemical Status of Springs of Dharamshala and Kangra Blocks, Himachal Pradesh, India
CUHP17RDENV05	Integrated disease management of the Wet Bubble Disease in white button mushroom ( <i>Agaricus bisporus</i> )	Integrated eco-friendly disease management of the Wet Bubble Disease in white button mushroom, <i>Agaricus bisporus</i> (Agaricaceae: Agaricales)
CUHP18RDENV02	Site characterisation of Shimla city using ambient noise measurements and response analysis of built environment	Site characterisation of Shimla city using ambient noise measurements and spectral response analysis of built up environment
CUHP17RDENV11	Glacier Dynamics of Ravi and Bhaga Basins Western Himalaya, India using Remote Sensing and Geospatial Tools	Glacier Dynamics of Ravi and Bhaga Basins of Western Himalaya, using Remote Sensing and Geospatial Tools
CUHP20RDENV01	Study of Spatio-Temporal Variation in Atmospheric Ammonia over District Kangra, Himachal Pradesh.	Studies on Spatio-Temporal Variation in Atmospheric Ammonia over District Kangra of Himachal Pradesh
CUHP20RDENV08	Metal Organic Framework based Composites for Electrochemical Sensing of Toxic Metal Ions	Studies on Metal Organic Framework based Composites for Electrochemical Detection of Toxic Metal Ions
CUHP17RDENV08	Synthesis of Carbon Based Nanocomposite for Electrochemical Detection of Pharmaceutical Drugs	Studies of Carbon Based Nanocomposite for Electrochemical Detection of Pharmaceutical Drugs
CUHP20RDENV06	Isolation of psychrotrophs from western Himalayas, Exploring their Biotechnological Applications	Studies on Isolation and Biotechnological Applications of Psychrotrophs from Western Himalayas
CUHP20RDENV09	Bioremediation Study of Fluoroquinolone Antibiotics and <i>in-silico</i> Analysis of Antibiotic Degrading Microbial Enzymes	Bioremediation Studies of Fluoroquinolone Antibiotics and <i>in-silico</i> Analysis of Antibiotic Degrading Microbial Enzymes
CUHP20RDENV02	Ecological Features of Atmospheric Nanoparticles and Green Synthesis of Nanoparticles as Alternative for Environmental Applications	Ecological Studies on Atmospheric Ultrafine Particles and Synthesis of Plant Derived Nanoparticles for Environmental Applications

Anurag Kishor  
13 Dec 2024

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13/12/2024

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## Annexure III

फाइल सं: 1-1/हि.प्र.कें.वि./शै/2010/खंड/VIII/7578

हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय

Central University of Himachal Pradesh  
(अकादमिक शाखा /Academic Branch)



धर्मशाला – 176215

दिनांक: 12 नवम्बर, 2021

### अधिसूचना

माननीय कुलपति महोदय के अनुमोदन के अनुसार विश्वविद्यालय में सभी स्नातकोत्तर (Post-graduate) स्तर की डिग्री पूर्ण करने हेतु 02 क्रेडिट का कोर्स "भारतीय ज्ञान पद्धति [Bhartiya Knowledge System(IKS)] सत्र 2021-22 से लागू किया जाता है जिसके Course Contents निम्न प्रकार से है इसके Learning Outcomes अलग से अधिसूचित किये जायेंगे:

**Credits: 2 (20 Hours)**

**UNIT -I: Bhāratīya Civilization and Development of Knowledge System (4 hours)**  
Antiquity of civilization, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, School of Philosophy (6+3), Ancient Education System, the Takṣaśilā University, the Nālandā University


**UNIT-II: Arts, Literature, and Scholars in Ancient Bharat (4 hours)**  
Art, Music, and Dance, Naṭarāja– A Masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Caraka, Suśruta, Kaṇāda, Kauṭilya, Pāṇini, Thiruvalluvar, Āryabhaṭa, Bhāskarācārya, Mādhavācārya.

**UNIT-III: Ancient Bhartiya Contribution towards Science & Mathematics (4 hours)**  
Sage Agastya's Model of Battery, Vedic Cosmology and Modern Concepts, Concept of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics; Kerala School for Mathematics and History of Culture of Astronomy, Astronomical \_\_\_ of day, year and Yuga.

**UNIT-IV: Ancient Bhartiya Engineering, Technology & Architecture (4 hours)**  
Pre-Harappan and Sindhu Valley Civilization, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet–Dwārka.

**UNIT-V: Ancient Bhartiya Contribution in Environment & Health (4 hours)**  
Ethnic Studies, Life Science in Plants, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Surgery, and Yoga, etc.

Amrinder Singh  
13/11/2021


  
12/11/2021  
(प्रो. विशाल सूद)

कुलसचिव(अतिरिक्त प्रभार)  
दिनांक: 12 नवम्बर, 2021

पृष्ठांकन: समसंख्या।

प्रतिलिपि:

1. अधिष्ठाता छात्र कल्याण, हि.प्र.के.वि., धौलाधार परिसर-1, धर्मशाला, जिला काँगड़ा (हि.प्र.)।
2. विभिन्न स्कूलों के सभी अधिष्ठाता/ विभिन्न विभागों/केन्द्रों के सभी विभागाध्यक्ष/निदेशक, शाहपुर परिसर/धौलाधार परिसर-1&II, धर्मशाला/सप्त सिन्धु परिसर, देहरा, जिला काँगड़ा।
3. वित्त अधिकारी, हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय, प्रशासनिक ब्लाक, धर्मशाला, जिला काँगड़ा।
4. परीक्षा नियंत्रक, हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय, प्रशासनिक ब्लाक, धर्मशाला, जिला काँगड़ा।
5. जन-संपर्क अधिकारी, धौलाधार परिसर-1, हि.प्र.के.वि., धर्मशाला, जिला - काँगड़ा (हि.प्र.)।
6. माननीय कुलपति के सचिव, कुलपति सचिवालय, हि.प्र.के.वि., धर्मशाला, जिला - काँगड़ा (हि.प्र.)।
7. सहायक कुलसचिव, कुलपति सचिवालय - कृपया माननीय कुलपति महोदय के सूचनार्थ।
8. गार्ड फाइल।

  
12/11/2021

कुलसचिव (अतिरिक्त प्रभार)

**Department of Environmental Science**  
**School of Earth and Environmental Sciences**

**Booklet of Course Contents**  
**For**  
**M.Sc. Environmental Science Program**



**हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय**

(2009 अधिनियम केन्द्रीय विश्वविद्यालय के तहत स्थापित)

धर्मशाला, जिला काँगड़ा-176,215

**Central University of Himachal Pradesh**

(Established under Central Universities Act 2009)

Dharamshala, District Kangra, Himachal Pradesh-176215

## Programs Offered

Currently the Department is offering M.Sc. programme in Environmental Science and Ph.D. programme in same subject

## Objectives of the Department

- To provide quality education and training in Environmental Sciences
- To pursue and facilitate research and development activities
- To establish working linkages with industry and undertake collaborative projects which offer long-term interaction opportunities with academia and industry
- To foster environmental awareness and promote the principles and practices of sustainable development.

## Thrust Areas of Research

- Water Resources Management
- Geosciences
- Air quality monitoring
- Phytoremediation and Bioremediation
- Solid Waste Management
- Environmental Nanotechnology
- Environmental Pollution Monitoring and Analysis

## Program Specific outcomes (PSO)

**PSO-1:** Knowledge about the natural resources, their status, importance and need for conservation

**PSO-2:** Understandings of natural disasters and their management approaches

**PSO-3:** Knowledge of environmental laws, acts, and standard for environmental compliance



## Program outcomes (PO)

- Basic and applied knowledge on the structure and function of the Earth's Environment: Basic understanding of Lithosphere, Hydrosphere, Cryosphere, Atmosphere and Biosphere to find solution for the complex environmental problems.
- Environmental Monitoring: Knowledge of various techniques to monitor the quality of Air, Water and Soil of ambient environment.
- Environmental and Disaster Management: Ability to understand and mitigate issues related with environmental pollution and natural hazards.
- Environmental Impact Assessment: Basic knowledge on impact assessment related to industrialization, urbanization and other developmental activities.
- Problem analysis: Ability to analyze society related / applied research problem, design and execute experiments to find relevant solutions.
- Indian Traditional Knowledge: Understanding about the Indian traditional knowledge practiced from generations to address environmental issues sustainably.
- Advanced Usage of Technology: Application of advanced instrumentation tools, online resources with an understanding of the troubleshooting and limitations.
- Ethics: Commitment towards professional ethics and responsibilities as a social endeavor to bring harmony with nature.
- Lifelong learning: Scientific skills for industrial applications and entrepreneurship

## On completing M.Sc. Programme, the students shall be able to realize following outcomes:

- Knowledge about the natural resources, their status, importance and need for conservation.
- Understand different natural and manmade disasters, Explore the reason of its origin and the possible antidotes so that it can dwindle to some extent.
- Implement environmentally sound strategies in this concern
- Knowledge of biodiversity, forest and wildlife ecology for their conservation and management.
- Enhancement of creative and critical thinking, aesthetic sensibility, and analytical skills.
- Understanding of the chemical processes that govern the natural and disturbed environments. Waste management practices for the betterment of environment and well beings.
- Understanding of the emerging regional and global environmental issues and their mitigations.

- Understanding the Environmental Impact Assessment and its methodologies for Industries and Regulators.
- Fundamental knowledge of instrumental methods employed in analysis of environmental samples.
- Understandings of natural disasters and their management approaches
- Knowledge of environmental laws, acts, and standard for environmental compliance
- Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction
- Evaluate Disaster Management study including data search, analysis and presentation as a case study.
- Create Technological innovations in Disaster Risk Reduction: Advantages and problems
- Understanding of environmental biotechnology and its applications in environmental issues and other biotechnology applications.

## Postgraduate Attributes

- On completion of the post graduate programme in Environmental Studies, students are expected to equip with the skills of creative, critical and rational thinking associated with Environmental Studies and its use for human society. The following attributes are expected from the students of M.Sc. Environmental Studies:
  - Disciplinary Knowledge
  - Creative and Critical Thinking
  - Reflective Thinking
  - Problem Solving
  - Analytical Reasoning
  - Communication Skills
  - Research Skills
  - Life Skills
  - Multicultural Competence
  - Moral and Ethical Values
  - Life-long Learning
  - Global Competency

## List of Courses to be offered to Research Degree Students of the Department of Environmental Sciences

<b>Course Type</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>	<b>Faculty</b>
<b>Compulsory Courses</b>	ENV 617	Research Methodologies in Natural Sciences	4	All Faculty Members
	ENV 619*	Research and Publication Ethics	2	Prof. Deepak Pant
	ENV 620*	Indian Traditional Knowledge and Practice	2	Dr.Anurag Linda
	ENV 621*	Pedagogy of Teaching Learning Process	2	Faculty Member from the Department of Education
<b>Elective Courses (At Least Two Courses for 8 Credits)</b>	ENV 622*	Mechanism of Toxicity and Detoxification	4	Prof.Deepak Pant
	ENV 623*	Advances in Environmental Pollution and Environmental Engineering	4	Dr. Ankit Tandon
	ENV 624*	Advances in Water Resources Management	4	Dr.Anurag Linda

\*Courses need to get approved in the next meeting of Board of Studies of the Department of Environmental Science

## List of Courses to be offered to M.Sc. Environmental Science Students of the Department of Environmental Sciences

**Proposed structure of courses to be offered in the Department of Environmental Sciences as per new Choice Bases Credit System (CBCS).Courses to be offered in the M.Sc. Environmental Sciences (semester I and III; July 2020-Dec.2020):**

<b>Semester I</b>		
<b>Total Credits</b>	<b>Major Courses</b>	<b>*Credits</b>
	ENV 401 – Introduction to Ecology	2
	ENV 402a – Introduction to Earth Processes	2
	ENV 403 –Environmental Chemistry	4
	ENV 501- Environmental Pollution and Human Health	2
	ENV 516- Atmospheric Science	2
<b>Minor Courses</b>		
	ENV 411- Waste Management	2
	ENV 503- Environmental Legislations National and international	2
<b>Vocational/ Skills</b>		
	ENV 445- Environmental Chemistry Laboratory	2
	ENV 418- Ecology Laboratory	2
<b>Indegenous Knowledge system</b>		
	ENV 508a- Indian Tradation and Environmental Ethics	2

<b>Semester II</b>		
<b>Total Credits</b>	<b>Core-Compulsory Courses</b>	<b>*Credits</b>
	ENV 408-Biodiversity and wildlife Management	2
	ENV 411 -Waste Management	2
	ENV 424-Fundamentals of Remote Sensing	2
	ENV 432-Introduction to Statistical Techniques	4
	ENV 436-Environmental Science Laboratory -II	2
	ENV 501-Environmental Pollution and Human Health	2
	ENV 422-Basics of Natural Resource	2
	ENV 508-Environmental Ethics	2
	ENV 553-Environmental Thermodynamics	2

<b>Semester III</b>		
<b>Total Credits</b>	<b>Core-Compulsory Courses</b>	<b>*Credits</b>
	ENV 412 – Analytical Techniques	2
	ENV 571 - Remote Sensing and GIS Lab	2

	ENV 531 – Toxicology Laboratory	2
<b>Core Open/ Elective Open</b>		
	ENV 404- Energy and Environments	2
	ENV 503- Environmental Legislations National and International	2
<b>Elective Specialization</b>		
	ENV 564- Near Surface Geophysics	4
	ENV 582- Atmospheric Chemistry and Physics	4
	ENV 586- Nano techniques and Applications in Environment	4
	ENV 557- Bio-resources and Environmental Biotechnology	4
	ENV 509- Glaciology	4

<b>Semester IV</b>		
<b>Total Credits</b>	<b>Core-Compulsory Courses</b>	<b>*Credits</b>
	ENV575- M.Sc Dissertation	6
<b>Core Open/ Elective Open</b>		
	ENV 536- Disaster Management	2
	ENV 583- Soil Science	2
	Env 428- Himalayan Geology	2
<b>Elective Specialization</b>		
	ENV 509- Glaciology	4
	ENV 588-Advanced Environmental Technology	4
	ENV 586- Nano techniques and Applications in Environment	4
	ENV 561 Bio-resources and Environmental Biotechnology	4
	ENV 610-Applied Biotechnology and Bioremediation	4

## Detail Syllabus of M.Sc. Environmental Sciences

[Faculties can modify the content as per their convenience and requirement]

### SEMESTER- I

**ENV 401: Introduction to Ecology**

**[2 Credits]**

**Course Code:** ENV 401

**Course Name:** Introduction to Ecology

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Introduce students to know the basic ecological principles.
- The students will acquire knowledge/**skill development** to explore the functional and Structural aspects of different ecosystems.
- Explore the concepts related to establish ecological balance in Nature.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

**UNIT (I)****4 hrs**

Scope of Ecology and Environmental Science, Historical aspects of Ecology, Major landmarks in Ecology.

**UNIT (II)****4 hrs**

Ecosystem concept, Biotic and Abiotic components, Structure and Functions of Ecosystem.

**UNIT (III)****4 hrs**

Food Chains, Food Webs, Energy Flow, Pyramids of Energy number and biomass, Factors affecting Productivity, methods of measurements of Productivity.

**UNIT (IV)****4 hrs**

Biogeochemical Cycling of Carbon Oxygen, Nitrogen and Phosphorus.

**UNIT (V)****4 hrs**

Species interaction, completion, Mutualism, Parasitism, predator Prey relations, Ecological Successions, Climax communities.

**TEXT BOOKS**

1. **Odum** P 1996. **Fundamentals of Ecology**. Natraj Publishers, Dehradun, pp 574; ISBN: 81-85019-55-X.
2. **Veena** 2009. **Understanding Ecology**. Discovery Publishing House Pvt. Ltd., pp 344; ISBN: 978-81-8356-456-4.
3. **Juneja**, J 2009. **Advances in Historical Ecology**. Cyber Tech. Publications, pp 296; ISBN: 978-81-7884-417-6.

**REFERENCE BOOKS**

**Allaby** M. **Ecology Facts**.

**Vanx** P C. **Ecology**

**Sanders** W K. **Biosphere**. Ecology in Practice.

**Benson**. **Ecology**. Ecosystem

**Hare** G O. **Soils vegetation, Ecosystem**.

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed the following **skill developments** of the students:

1. To introduce the students to basics of the earth structure and its physical, chemical and biological characteristics.
2. To introduce the students to various earth processes that are operating inside the earth and their role in shaping and evolution of earth.
3. Introduction with the surface geological processes (weathering, erosion etc) and their use in understanding geochemical cycling of elements and their role in maintaining the earth surface temperature and associated phenomenon such as geochemical cycling of elements and climatic implications.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

**UNIT I**

**(2 hrs)**

- Earth Science as a subject and its various disciplines



- Evolution of various branches of Earth Science

## UNIT II

(4 hrs)

- Modern theories on the origin of the Earth and other planetary bodies and Primary differentiation of the earth.
- Different theories of origin and evolution of the earth.
- Multilayer Structure of Earth
- An overview on different rock types and mineral groups

## UNIT III

(5 hrs)

- Origin of magma and magmatic rocks
- Temperature, pressure and fluids inside the earth and metamorphic rocks.
- Weathering and erosion processes and their role in elemental redistribution
- Sediment transport and deposition through running water, wind and glaciers and formation of sedimentary rocks and various landforms

## UNIT IV

(6 hrs)

- Theory of Plate tectonics and its implications in understanding mountain building and sea floor spreading processes
- Formation of oceans, continents and mountains
- Distribution of earthquake and volcanic activity across the globe

## UNIT V

(3 hrs)

- Land-ocean interaction and biogeochemical cycling
- Paleogeography and palaeoclimate

## TEXT BOOKS

1. Keller E A 2010. **Environmental Geology**. 9th Edition, Prentice Hall, ISBN-13: 978-0321643759.
2. Duff P M and Duff D 1993. **Holmes Principles of Physical Geology**. 4<sup>th</sup> Edition, Stanley Thornes, ISBN 0748743812, 9780748743810.
3. Tank, R W. **Environmental Geology**. Oxford University Press ISBN10: 0195032888 / ISBN 13: 9780195032888.

4. Aldiya K. S 2010. **The Making Of India Geodynamic Evolution**. Macmillan India Ltd, ISBN 13: 9780230328334

#### REFERENCE BOOKS

1. Mahapatra G.B 2011. **Textbook Of Geology** CBS publications, ISBN 8123900139; ISBN-13-9788123900131.
2. **The Changing Earth: Exploring Geology and Evolution**. 4<sup>th</sup> edition, Brooks/Cole Publishing Co; ISBN-10: 0495010200; ISBN-13: 978-0495010203
3. Fluvial Processes in Geomorphology. Dover Publications, ISBN-10:0486685888; ISBN-13:978-0486685885
4. Burbank D W and Anderson R S 2000. Tectonic Geomorphology. 1st edition Wiley-Blackwell, ISBN-10: 0632043865; ISBN-13: 978-0632043866
5. Subramanian V. **A Textbook in Environmental Science**. Narosa Publishers, ISBN13:978-0849324086.
6. Valdiya K S. Environmental Geology, Indian Context. **Tata McGraw-Hill Pub Co**. ISBN 10: 0074519719 / 0-07-451971-9; ISBN 13: 9780074519714
7. Kumar R 1985. **Fundamentals Of Historical Geology And Stratigraphy Of India**. Wiley Eastern, ISBN 0852267452, 9780852267455.

**ENV 403 Environmental Chemistry**

**[2 Credits]**

**Credits Equivalent:** 4 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed for the knowledge and following skill development of the students:

1. introduce students to the fundamental concepts of analytical techniques environmental chemistry;

2. provide knowledge about various kinds of quantitative techniques;
3. introduce about computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:****UNIT I: (12 hrs)**

Stoichiometry, Gibbs' energy, chemical Potential, chemical equilibrium acid base reactions, Solubility product, solubility of gases in water, the carbonate system, Unsaturated and saturated hydrocarbons, radio nuclides.

**UNIT II: (8 hrs)**

Chemical compositions of Air: Classification of elements, chemical speciation, Particles, Ions and radicals in atmosphere, chemical processes for formation of inorganic and organic particulate matter, thermo chemical and photochemical reaction in atmosphere Oxygen and Ozone chemistry, chemistry of air pollutants, photochemical smog.

**UNIT III: (4 hrs)**

Water Chemistry: Chemistry of water, Concept of DO, BOD, COD, Sedimentation coagulation, filtration, redox potential.

**UNIT IV:****(4 hrs)**

Soil Chemistry: Inorganic and organic components of soil, Nitrogen pathways and NPK in soils.

**UNIT IV:****(12 hrs)**

Main and transition metals Chemistry, Metal- Ligand concept and its implication towards biochemistry of metals.

**TEXT BOOKS:**

1. Manahan, Stanley E. "FRONTMATTER"*Environmental Chemistry* Boca Raton: CRC Press LLC, 2000.
2. A K De Environmental Chemistry 4<sup>th</sup> Edition, New Age International (P) Ltd., New Delhi 110 002.

**REFERENCE BOOKS:**

1. Jayaraman, J., Laboratory Manual In Biochemistry, New Age International (P) Limited.
2. Puri Sharma & Kalia, Principles of Inorganic Chemistry, S. Chand and company, N Delhi.
3. Keith Bucher, Global Climate, Wiley, New York 1976.
4. J. Heichlen, Atmospheric Chemistry, Academic Press, New York 1976.
5. Levin, Aerosol pollution impact on precipitation. New York Springer, 2009.
6. Rao, M N Air pollution, New Delhi: TMH, 2010.
7. Bali, J.S Bioindustrial watershed management. New Delhi: JCS, 2005.

**ENV 501 Environmental Pollution and Human Health**

**2 Credits**

**Course Objectives& outcome of the course:**

The course is designed to enhance following **skills:**

- Introduce students to know kinds and causes of Environmental pollution in the twenty-first century.
- Acquire knowledge of adverse effects of pollution on Human Health.
- Discuss the detailed biological mechanism on how pollutants affect human/animal health

- Explore the concepts related to monitoring and assessment of environmental pollution and Human Health.
- Find the way out and Governmental Policies around the globe.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in the examination.

**Course Contents:**

**UNIT (I):**

**5hrs**

Brief introduction about environmental pollutants and their detrimental effects. Endocrine Disrupting Chemicals [Phthalate, Bisphenol A, lindane ,Dioxins & furans, Poly-chlorinated biphenyls (PCBS), Atrazine, Penta chloro phenol(PCP), DDT and metabolites , Nonylphenol (NP), drugs, heavy metals (arsenic, lead, cadmium , mercury)]: sources, uses, health effect with detail biological mechanism [e.g. Hormone Mimicry, Blocking Hormone Receptors, Altering Hormone Metabolism].

**UNIT (II):**

**5hrs**

Radiation and Human Health, different sources of the exposure of Radiation to human beings- atomic, ultraviolet, electromagnetic radiation. Impacts of Radiation on Human Health. Basic mechanism of radiation's effect on human health.

**UNIT (III):**

**5hrs**

Water Pollution and Human Health. Pollution by microplastic, microbeads, microfibers: Sources, distribution, environmental impact.Effect of microplastic in ocean health and mechanism of pollution. Deleterious Effect in the food chain, on Plankton and corals health. Ocean pollution- a threat to human health. Way out and Governmental Policies.

**UNIT IV**

**5hrs**

Heavy metal contamination: sources, uses, health effect with detailed biological mechanism.

## Suggested Readings

1. Mahajan, S.P. Pollution Control in Process industries. Tata Mc Graw Hill Pub. Co Ltd. New Delhi.
2. Rao, C.S. 2009. Environmental Pollution Control Engineering. Wiley Eastern Ltd., New Delhi

## REFERENCE LITERATURES

1. C. Frye et. al. 2012, Endocrine disrupters: a review of some sources, effects, and mechanisms of actions on behavior and neuro-endocrine systems. *J Neuroendocrinol.* January; 24(1): 144–159.
2. Shinji Fushiki. 2013. Radiation hazards in children – Lessons from Chernobyl, Three Mile Island and Fukushima-Review. *Brain & Development*, 35, 220–227.
3. Magda Havas. Biological Effects of Low Frequency Electromagnetic Fields. CHAPTER 10, *Electromagnetic Environments and Health in Buildings*. Spon Press, London, 535 pp.
4. Stephen A Stansfeld and Mark P Matheson. 2003. Noise pollution: non-auditory effects on health. *British Medical Bulletin*; 68: 243–257.
5. Bates, D.V. 1980. The health effects of Pollution. *J Respire. Dis.* 1 : 29-37
6. De Gruigle, F.R. 1997. Health Effects from solar UV radiations. *Radiation Protection Dosimetry.* 72:177-196.

**ENV 516- Atmospheric Science**

**[2Credits]**

**Credit Equivalent: 2 Credits (1 Credit is equivalent to 10 hours of theory (Classroom activity) and 5 hours of practical (Laboratory work).**

### Vision

Atmospheric science is an applied discipline that is concerned with the structure and evolution of the Earth's atmosphere and with the wide range of phenomena that occur within them. Atmospheric science represents a particular fusion of elements of physics and chemistry. This course will serve to introduce the student to the fundamental principles upon which the atmospheric processes are based and to provide an elementary description and interpretation of the wide range of atmospheric phenomena.

Atmospheric science is a multifaceted subject dealing with several disciplines such as oceanography, meteorology, geology, biology, chemistry, physics and other disciplines to understand Atmospheric processes as an integrated system. An increasing number of scientists are devoting their research to understand the earth processes to address the issues like global warming, sea-level rise, climate change and so on. As all these above mentioned issues are of global significance and in a way or other are linked to the earth system sciences, a sound knowledge (material, processes and their interaction) of the subject would certainly help in developing strategies to meet these challenges.

### **Objectives**

1. The Earth's Atmosphere- an overview
2. Understanding physical structure and chemical composition of the Earth's Atmosphere
3. Understanding the fundamental physical and chemical processes responsible for the mass and energy transport in the Earth's Atmosphere

### **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75 percent attendance is a must failing which a student may not be permitted to appear in examination.

### **Evaluation Criteria:**

Mid-term Examination: 25%

End-term Examination: 50%

Continuous Internal Assessment: 25%

### **Course contents**

#### **Unit 1: Vertical Structure and Composition (4 Hours)**

- Chemical Composition
- The State of the Atmosphere
- Atmospheric Density and Pressure
- Hydrostatic Balance

#### **Unit 2: Atmospheric Thermodynamics (4 Hours)**

- The Ideal Gas Law and First Law of Thermodynamics
- Concept of Air Parcel and Lapse Rates
- Atmospheric Stability
- Mixing Height and Inversion

**Unit 3: Atmospheric Energy Balance (4 Hours)**

- Electromagnetic Radiations, Black Body Radiation
- The Solar Constant and the Budget of Solar Radiation
- Terrestrial Radiation, The Earth's Radiative Energy Balance
- Green House Effect

**Unit 4: Atmospheric Chemistry (4 Hours)**

- Thermo-chemical and Photo-chemical Reactions
- Chemistry of Stratosphere, Stratospheric Ozone Depletion
- Chemistry of Troposphere, Acid Rain
- Atmospheric Aerosols, Atmospheric Trace Gases

**Unit 5: Atmospheric Dynamics (4 Hours)**

- Pressure Belts and Winds
- Pressure Gradient Force
- Coriolis Force, Centrifugal Force, Friction,
- Global Circulation

**Suggested Readings:**

**Murry L. Salby** (2012): Physics of the Atmosphere and Climate, **Cambridge University Press**, ISBN: 978-0521767187

**Kevin E. Trenberth** (2010): Climate System Modeling, **Cambridge University Press**, ISBN: 978-0521128377

**Wallace John M. Jr., Peter V. Hobbs** (2006): Atmospheric Science: An Introductory Survey, 2nd Edition, **Academic Press**, ISBN: 978-0127329512

**John Green** (2011): Atmospheric Dynamics, **Cambridge University Press**, ISBN: 978-0521249751

**Frederick K. Lutgens, Edward J. Tarbuck** (2010): The Atmosphere: An Introduction To Meteorology, **Phi (Prentice-hall New Arrivals)**, ISBN: 978-8120344150



**Mark Z. Jacobson** (2005): Fundamentals of Atmospheric Modeling, **Cambridge University Press**, ISBN: 978-0521548656

**John H. Seinfeld, Spyros N. Pandis** (2006): Atmospheric Chemistry and Physics, **John Wiley & Sons Inc.**, ISBN: 978-0-471-72018-8

**Barbara J. Finlayson-Pitts, Pitts James N. JR., James N. Pitts Jr.** (1999): Chemistry of the Upper and Lower Atmosphere: Theory, Experiments, and Applications, **Academic Press** ISBN: 978-0122570605

## ENV 411 - Waste Management

[2Credits]

**Course Objectives:** To provide the basic knowledge of waste management and involve Chemistry and its associated applications.

**Course Outcomes:** After completing this course, student is expected to develop the following skills :

**CO1:** Basic understanding of biodegradable solid waste

**CO2:** Basic understanding of hospital and pharmaceutical waste

**CO3:** Basic understanding of non-biodegradable solid waste

**CO4:** Skills for developing sustainable methods

**CO5:** Development of the skill of the management plans

**CO6:** Skill development towards hybrid methods

### COURSE SYLLABUS:

#### UNIT 1 :BIODEGRADABLE SOLID WASTE

[Course Outcome (s) No. :1 and 5]

Biodegradable solid waste: Chemical composition and classification: Source and generation: Health hazards: Management Techniques

#### UNIT 2:NON-BIODEGRADABLE SOLID WASTE

[Course Outcome (s) No. :2 and 5]

Non-Biodegradable Solid waste: Sources, generation, chemical composition, classification of plastic waste and its management: Sources, generation, chemical composition, classification of e-waste and its management.

#### UNIT 3: HOSPITAL AND PHARMACEUTICAL WASTE

[Course Outcome (s) No. :3 and 5]

Hospital and Pharmaceutical Waste: Classification: Source and generation: Health hazards: Management Techniques

#### UNIT 4: WASTE MINIMIZATION TECHNOLOGIES

[Course Outcome (s) No. :4 and 6]

Waste minimization technologies: Reuse/ recycling of different types of waste: Metal recovery from waste using chemical, biological and hybrid techniques.

### Suggested Readings:

1. D. Pant, D. Joshi, M. K. Upreti and R. K. Kotnala, Chemical and Biological Extraction of Metals Present in E Waste: A Hybrid Technology, Waste Management, Elsevier Science, Vol. 32, pg. 979-990, 2012.

2. D. Pant, R. Singh, S. Kumar, Management of Waste Poly Vinyl Chloride (PVC) through Chemical Modification, ScInd Res., Vol. 71, pg. 181-186, 2012.
3. D. Pant, Waste Management in Small Hospitals Trouble for Environment, Environmental Monitoring and Assessment, Springer, 2011.
4. D. Pant, Pharmaceutical Waste Management, Lambert Academic, 2011.
5. D. Pant, Electronic Waste Management Lambert Academic Publishing, 2010.
6. Frank Kreith, Handbook of Solid Waste Management, McGraw-Hill, Inc., New Delhi, 1994.
7. M. Roy III. Harrison, Pollution; Causes, Effects and Control. The Royal Society of Chemistry, Cambridge, 1994.

John R. Holmes, Practical Waste Management, John Wiley & Sons, New York/Singapore, 1983.

### ENV 503 -Environmental Legislations National and international [2Credits]

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to **enhance the skills** of students in the following field:

- To familiarize the students with fundamental right to clean environment and duties.
- The students will realize and underline the **need for environmental legislations, and legislative powers of the Parliament.**
- **Students will acquire knowledge about different Environmental legislations at national level and conventions/protocols/treaties for conservation of Environment at international level.**
- **Students will learn about the Environmental legislation enforcement authorities, Environmental dispute redress bodies and the International Organizations for Conservation of Environment.**

#### **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

#### **Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25%

- a. Assignment: 10%
- b. Class Test: 5%
- c. Presentation: 10%

## **COURSE CONTENT**

### **UNIT (I)**

**1 hrs**

1. Introduction to Environmental Law, Powers of the Parliament to legislate Environmental legislations.
2. Status of Environmental legislations in India: Enumeration of Environmental legislations.

### **UNIT (II)**

**4 hrs**

#### **Legislation enforcement authorities under:**

1. The **Environmental** water (Prevention and Control of Pollution) Act, 1974 – composition, powers and functions.
2. The Air (Prevention and Control of Pollution) Act, 1981 – composition, powers and functions.
3. The Environment (Protection) Act, 1986 – powers, EIA Notification, 2006.

### **UNIT (III)**

**5 hrs**

#### **Environmental legislations and dispute redress bodies in India:**

1. The Wildlife (Protection) Act, 1972: Objectives, National Board for Wildlife (NBWL)
2. The Forest (Conservation) Act, 1980: Objectives and Mechanism.
3. The Biological Diversity Act, 2002: Objectives, National Biodiversity Authority.
4. National Green Tribunal- Composition and jurisdiction

### **UNIT (IV)**

**2 hrs**

1. International Organizations for Conservation of Environment: UNEP, WWF, IUCN, IGBP.

### **UNIT (V)**

**8 hrs**

#### **International Environmental Conventions, Protocols and Treaties:**

1. Ramsar Convention on Wetlands.
2. United Nations Conventions and Protocols on Climate Change, Ozone depletion, Biodiversity,

Forest and Agenda -21.

### TEXTBOOKS

1. Environmental Laws, 2005. Universal Law Publishing.
2. S.C. Santra, 2005, Environmental Science, New Central Book Agency (P) Ltd 8/1 Chintamani Das Lane, Kolkata- 700009

### REFERENCE BOOKS

1. S. Diwan and A. Rosencranz, 2005, Environmental Laws and Policy in India.
2. Mallick, M. R. (Justice) 2010. Environmental Laws, Professional Book Publisher New Delhi
3. Rana S. V. S. 2005, Essentials of Ecology and Environmental Science, Prentice Hall of India Pvt. Ltd. New Delhi.

**ENV 508a -Environmental Ethics**

**[2Credits]**

### Course Objectives & outcome of the course:

Ethics are a broad way of thinking about what constitutes a good life and how to live one. They address questions of right and wrong, making good decisions, and the character or **skills development** for the necessary to live a good life. Applied ethics address these issues with a special emphasis on how they can be lived out practically. Environmental ethics apply ethical thinking to the natural world and the relationship between humans and the earth. Environmental ethics are a key feature of environmental studies, but they have application in many other fields as human society grapples in a more meaningful way with pollution, resource degradation, the threat of extinction, and global climate disruption.

The learning goals are:

1. to understand the essential features of moral or ethical thinking; To become acquainted with concepts and methods of philosophical ethics that apply to issues regarding mankind's dealings with the natural world.

2. to learn about the important and distinguishing characteristics in environmental ethics;
3. to develop the skills to recognize and deploy moral discourse for leadership in environmental fields.
4. to understand what kinds of environmental problems lead us to follow environmental ethics and to critically assess alternative approaches to, and defenses of, a code of responsibility to nature.
5. to give some future direction towards the protection and ethical use of the environment
6. To offer the student a repertory of resources and skills with which to formulate his/her own environmental ethic and to articulate and defend these ideas with clarity, consistency, and coherence.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in the examination.

**Course Contents:**

**Unit I**

**8hrs**

Environmental Ethics: Definition. Principles. Need of the subject at present time. Moral standing. Human responsibilities towards nature, environment, and other species. Anthropocentric ethics, intrinsic and instrumental values. Our relationship with nature/environment. Vital questions to be asked. Thinking with Ethics.

**UNIT II**

**4 hrs**

The social construction of nature. Human impact on the environment. Examining both the nature of the issues and their causes. Earth overshoot day. Environmental ethics and society. Relevance of Environmental ethics to environmental protection.

**UNIT III**

**4 hrs**

The state of the World Environment: Significant global environmental issues. Examining both the nature of the issues and their causes. Recent incidents due to climate change and its effect. Effect and consequences of climate change on Ecosystems and Biodiversity. Climate migration.

#### UNIT IV

4hrs

Responsibility towards the Environment. International and National efforts for Environment Protection. Sustainable living.

#### Suggested Readings

1. Kimberly K Smith. 2018. Exploring environmental ethics - an introduction. Springer.
2. Dale Jamieson. 2008. Ethics and the Environment- an introduction. Cambridge University Press

#### General recommended reading in environmental ethics

1. Callicott, J.B., 1997. Earth's Insights: A Multicultural Survey of Ecological Ethics from the Mediterranean Basin to the Australian Outback University of California Press, Berkeley.
2. DesJardins, J.R., 2006. Environmental Ethics: An Introduction to Environmental Philosophy. Wadsworth, Belmont, California.
3. Martin-Schramm, J.B. and Stivers, R.L., 2003. Christian Environmental Ethics: A Case Method Approach. Orbis, Maryknoll, New York.

ENV 445- Environmental Chemistry Laboratory

[4 Credits]

ENV 418- Ecology Laboratory

[4 Credits]

## SEMESTER- II

### ENV 408 - Biodiversity and wildlife Management

[4 Credits]

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Introduce students to know kinds, distribution significance and use of Biodiversity and wildlife.
- The students will acquire skills and knowledge to study, save and conserve Biodiversity and Wildlife.
- Explore the concepts related to identification, monitoring and assessment of Biodiversity and Wildlife.

#### **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

#### **Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

#### **Course Contents:**

##### **UNIT I**

**4 hrs**

Concepts of Biodiversity, Levels of Biodiversity, Mega Diversity areas, Hot Spots of the Biodiversity, Biodiversity Resources in Himachal Pradesh, Dependence on Biodiversity.

**UNIT II****4 hrs**

Loss of Biodiversity, Monitoring and Inventorization of Biodiversity, Alpha, Beta and Gamma diversities. Shanon Index. Biodiversity data base in Himalayas, Threat Categorization of Biodiversity, Documentation of Biodiversity.

**UNIT III****4 hrs**

Modern Techniques of Measurement and Assessment of Biodiversity, Economics of Biodiversity, Uses of Biodiversity (including folk and traditional uses).

**UNIT IV****4 hrs**

*EX-SITU* Conservation methods of Biodiversity, *IN-SITU* Conservation methods of Biodiversity, Protected areas Networks

**UNIT V****4 hrs**

Wildlife distribution at National and Global level, Wildlife trade, Wildlife Sanctuaries, National Parks, Biosphere Reserves, Tiger Projects, Elephant Projects Crocodile Projects

**TEXT BOOKS**

1. **Khan, T.I. 2001.** Global Biodiversity and Environmental Conservation. Pointer Publisher. Jaipur
2. **Kotwal, P.C. and Banerjee, S. 1998.** Biodiversity Conservation – in managed forests & protected areas. Agro Botanica Publishers & Distributors. PP.227. ISBN: 81-87167-00-9.
3. **Ramkrishnam, N. 2006.** Biodiversity in Indian Scenarios. Daya Publishing House, New Delhi. PP.338. ISBN: 81-7035-443-9.

**REFERENCE BOOKS**

1. **Agarwal, K.C. 1998.** Biodiversity. Agro Botanica, Bikaner. PP. 150.
2. **Agarwal, S.K. et.al. 1996.** Biodiversity and Environment. A.P.H. Publishing Corporation. PP.351. ISBN: 81-7024-740-3.
3. **Biswas, S. 2007.** Biodiversity Conservation (A genetic approach). Oxford Book Company. PP. 347. ISBN : 81-89473-01-8.



4. **Chakraborty, S. 2004.** Biodiversity. Pointer Publishers. PP. 136. ISBN: 81-7132-384-7.
5. **Chaudhari, A.B. and Sarkar, D.D. 2002.** Biodiversity Endangered (India's threatened wildlife and medicinal plants). Scientific Publishers, Jodhpur, India. PP. 359. ISBN: 81-7233-312-9.
6. **Dhyani, S.N. 1994.** Wildlife Management. Rawat Publications, Jaipur (Raj.). PP. 258. ISBN: 81-7033-242-5.
7. **Ildos, A.S. and Bardelli, G.G.** The Great National Parks of the World. Om Book Service, New Delhi. PP.320. ISBN: 81-87107-06-5.

### ENV 411 - Waste Management

[4 Credits]

**Credit Equivalent:** 4 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Understand nature of human induced environmental pollutions like waste, its significance,
- Sources, compositions and types.
- Initiate initiatives for integrated/sustainable waste management options.

### Attendance Requirement:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

### Evaluation Criteria:

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%

c. Practical: 60%

**Course Contents:**

**Unit 1**

**(4 hrs)**

**Biodegradable solid waste**

- Chemical composition and classification.
- Source and generation
- Health hazards
- Management Techniques

**Unit 2**

**(8 hrs)**

**Non Biodegradable Solid waste**

- Sources, generation, chemical composition, classification of plastic waste and its management.
- Sources, generation, chemical composition, classification of e -waste and its management.

**Unit 3**

**(4 hrs)**

**Hospital and Pharmaceutical Waste**

- Classification.
- Source and generation
- Health hazards
- Management Techniques

**Unit 4**

**(4 hrs)**

**Waste minimization technologies**

- Reuse/ recycling of different types of waste
- Metal recovery from waste using chemical, biological and hybrid techniques

### TEXT BOOKS:

1. Kreith, Frank (ed.) (1994) Handbook of Solid Waste Management, McGraw-Hill, Inc., New Delhi.
2. Pant D., Electronic Waste Management Lambert Academic Publishing 2010 (ISBN 978-3-8433-8336-3)
3. Pant D., Pharmaceutical Waste Management Lambert Academic Publishing 2011 (ISBN 978-3-8454-4089-7)

### REFERENCE BOOKS

1. Holmes, John R. (ed.) (1983) Practical Waste Management, John Wiley & Sons, New York/Singapore.
2. Ill. Harrison, M. Roy (ed.) (1995) Pollution; Causes, Effects and Control. The Royal Society of Chemistry, Cambridge cb4 4wf.

### RESEARCH PAPER:

1. Pant D.: "Waste Management in Small Hospitals Trouble for Environment" (2011) Environmental Monitoring and Assessment (Springer) DOI: 10.1007/s10661-011-2276-3.
2. Pant D., Joshi D., Upreti M. K. and Kotnala R. K. "Chemical and biological Extraction of Metals Present in E waste: A Hybrid Technology" (2012) Waste Management (Elsevier Science) 32,979-990.
3. Pant D, Singh R., Kumar S "Management of Waste Poly Vinyl Chloride (PVC) through Chemical Modification" (2012) J Sc Ind Res 71, 181-186

### ENV 424- Fundamentals of Remote Sensing

[4 Credits]

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** This is a skill development course and is designed to:

- Introduce the basics of Remote Sensing
- cover its various components and the use of remote sensing to address various environmental issues and management of natural resources

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

4. Mid Term Examination: 25%
5. End Term Examination: 50%
6. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

**UNIT I**

**4 hrs**

What is Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Interactions with the Atmosphere, Radiation – Target, Passive vs. Active Sensing, Characteristics of Images

**UNIT II**

**4 hrs**

Sensors on the Ground, in the air, in Space, Satellite Characteristics, Pixel Size and Scale, Different Resolutions, Cameras and Aerial Photography, Different Satellites, Other Sensors

**UNIT III**

**4 hrs**

Radar Basic, Viewing Geometry & Spatial Resolution, Airborne vs Spaceborne Radars, Airborne & Spaceborne Radar Systems

**UNIT IV**

**4 hrs**

Image Analysis: Visual interpretation, Digital processing, Preprocessing, Enhancement, Transformations, Classification, Integration

**UNIT V**

**4 hrs**

Applications: Agriculture, Glaciology, Forestry, Geology, Hydrology, Sea Ice, Land Cover, Biomass Mapping, Oceans & Coastal

**Suggested Readings:**

1. **Lillesand & Keifer**, (2011): Remote Sensing & Image Interpretation, **John Wiley & Sons**, ISBN: 9788126532230.
2. **James B.Campbell**,(2007): Introduction to Remote Sensing, **Taylor & Francis**, ISBN: 9780415416887.
3. **J.R.Jensen**, (2009): Remote Sensing of the Environment, **Pearsons education Pub.** ISBN: 9788131716809.
4. **George Joseph**, (2005): Fundamental of Remote Sensing, **University Press, India**, ISBN: 9788173715358.
5. **Bruce Grubbs**, (2005): Basic Essentials Using GPS, **Falcon Press Publishing**, ISBN: 9780762734214.

**ENV 432- Introduction to Statistical Techniques**

**[4 Credits]**

**ENV 434 - Fundamentals of Ecology and Environment**

**[4 Credits]**

**ENV 436- Environmental Science Laboratory -II**

**Course Name: Environmental Science Laboratory -II**

**Course content:** Field oriented experiments

- Use of Global Positioning system (GPS) in the field, mapping of different geological features and preparation of any map using GPS  
Lab-2 AL
- Cross section preparation of geological features in the field -----Lab-2 AKM
- Measurement of dip and strike in the field-----Lab-2 AKM

**ENV 501- Environmental Pollution and Human Health**

**[4 Credits]**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to enhance the knowledge and provide the students the **skill for employability** :

- Introduce students to know kinds and causes of Environmental pollution in twenty first century.
- The students will acquire knowledge of of adverse effects of pollution on Human Health.
- **Explore the concepts related to monitoring and assessment of Environmental pollution and Human Health.**

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)

- a. Assignment/Quiz/Term Paper: 20%
- b. Presentation/Seminar/Field work: 20%
- c. Practical: 60%

**Course Contents:**

**UNIT I**

**4 hrs**

Radiation and Human Health, different sources of exposure of Radiation to human beings, Impacts of Radiation on Human Health.

**UNIT II**

**4 hrs**

Thermal Pollution and Human Health, Magnitude of Thermal Pollution in India, Coal based and Gas based thermal pollution.

**UNIT III**

**4 hrs**

Noise Pollution Sources and Magnitude, Noise Standards, Biomedical aspects of Noise Pollution

**UNIT IV**

**4 hrs**

Air Pollution and Human Health, Types of Air Pollutants, Sources of emissions of Air Pollutants and impacts on Human Health

**UNIT V**

**4 hrs**

Water Pollution and Human Health, Types and Sources of Water Pollution, Water Pollution Standards, Water related and Water based diseases.

**TEXTBOOKS**

3. Mahajan, S.P. Pollution Control in Process industries. Tata Mc Graw Hill Pub. Co Ltd. New Delhi.
4. Rao, C.S. 2009. Environmental Pollution Control Engineering. Wiley Eastern Ltd., New Delhi

**REFERENCE BOOKS**

1. BATES, D.V. 1980. The health effects of Pollution. J Respire. Dis. 1 : 29-37

2. Benitez, J.1993.Process Engineering and Design for Air Pollution Control.Prentice Hall. New Jersey, USA
3. De Gruigle, F.R. 1997.Health Effects from solar UV mediations.Radiation Protection Dosimetry. 72:177-196.
4. Gamble, J.F. and Lewis, R.J.1996. Health and Respirable Particulate, air Pollution a casual or statistical association. Env. Health Perspective. 104:838-850.

### **ENV 434 - Fundamentals of Ecology and Environment**

**[4 Credits]**

#### **UNIT I: SCOPE AND INTRODUCTION**

Ecology- Scope, Subdivisions, major landmarks in Ecology, levels of organization hierarchy; Organisms and Environment-Holocoenotic nature of environment: Abiotic components (climatic and topographic factors), Biotic components (positive interactions-Mutualism, commensalism, proto-cooperation; Negative interactions-Exploitation, Antibiosis, competition).

#### **UNIT II: POPULATION ECOLOGY**

Population characteristics-Population Size and Density, Dispersion, Age structure, Natality, Mortality and Life Tables; population dynamics and concept of carrying capacity; Regulation of population growth.

#### **UNIT III: COMMUNITY ECOLOGY**

Community concept and brief classification, community characteristic, characters used to describe community structure- analytical, qualitative and synthetic characters, methods of community studies, species diversity  $\alpha$ ,  $\beta$  and  $\gamma$ ); concept of ecological niche- types, ecotone & edge effect.

#### **UNIT IV: COMMUNITY DEVELOPMENT**

Ecological succession-concept, causes and trends; Basic types of succession, General process of succession, Hydrosere, Lithosere, Heterotrophic succession, Ecosystem Development, concept of climax, Biome.

#### **UNIT V: ECOSYSTEM ORGANIZATION AND MANAGEMENT**

Concept of Ecosystem, Trophic structure of ecosystem, Examples of Ecosystem-A pond and an Old field or grassland ecosystem, Ecological pyramids-Pyramids of number, biomass and energy, Productivity of Ecosystem-Primary, Secondary and Net Productivity, Grazing and detritus food chains, Food web, Energy flow in ecosystem (simplified energy flow diagram depicting three trophic levels in a linear food chain), Biodiversity hot spots-Concept, brief introduction to biodiversity hot spots of India.

### **ENV 560 – Meteorology and Climatology**

**[4 Credits]**



## **Unit 1: Composition, Structure and Thermodynamics**

- Chemical Composition
- The State of the Atmosphere
- Atmospheric Density and Pressure
- Hydrostatic Balance
- The Ideal Gas Law and First Law of Thermodynamics
- Concept of Air Parcel and Lapse Rates
- Atmospheric Stability, Mixing Height and Inversion

## **Unit 2: Atmospheric Energy Balance and Dynamics**

- Electromagnetic Radiations, Black Body Radiation
- The Solar Constant and the Budget of Solar Radiation
- Terrestrial Radiation, The Earth's Radiative Energy Balance
- Green House Effect
- Pressure Belts and Winds
- Pressure Gradient Force, Coriolis Force, Centrifugal Force, and Frictional Force
- Geostrophic and gradient winds, thermal wind
- Global Circulation

## **UNIT 3: Climate Variability and Climate Modeling**

- Low frequency climate variability: MJO (Madden-Julian oscillation), ENSO, QBO (quasi-biennial oscillation) and sunspot cycles
- Basic principles of General Circulation Modelling

## **UNIT 4: Climatology**

- Latitudinal and Seasonal Variation of Insolation
- Temperature, Pressure, Wind Belts, Humidity
- Classification of Climates – Koppen's and Thornthwaite's scheme of classification.

## **Unit 5: Weather Systems**

- Extratropical Cyclones: Air Masses, Fronts, Jet Streams,
- Tropical Cyclones: Structure, Thermodynamics, and Dynamics, Genesis and Life Cycle,
- Cloud Formation: Condensation Nuclei, Growth of Cloud Drops and Ice-Crystals, Cloud Classification,
- Precipitation mechanisms: artificial precipitation, hail suppression, fog and cloud – dissipation,
- Indian Monsoon: El-Nino and ENSO

**ENV 435 - Environmental Sciences Laboratory – I****[2 Credits]****Course Name: Environmental Science Laboratory -I****Course Objectives: Skill Development**

Introduce students to different geological problem, The students will acquire knowledge to map any geological feature in the field explore the functional and Structural aspects different tectonic features, Learn different sampling and measurement techniques, Will also learn use of GPS in the field and prepare map of any region.

**Course content: Field oriented experiments**

- Field work in and around Dharmshala for Reading of toposheets -----Lab-1 AKM
- Identification of different structures in the field -----Lab-1 AKM
- Identification of minerals and rocks in the field----- Lab-1 AI
- Sampling techniques for geological samples-----Lab-1 AI

**SEMESTER- III****ENV 412 – Analytical Techniques****[2 Credits]**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

1. introduce students to the fundamental concepts of analytical techniques environmental monitoring;
2. provide knowledge and skills about various kinds of quantitative techniques;

3. Skill development in computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:****UNIT I****(4 hrs)**

Computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values with special reference to volumetric and gravimetric analysis, calibration of analytical equipments.

**UNIT II****(4 hrs)**

Methods of expressing concentrations, primary and secondary standards. Theory and indicators for neutralizations, oxidation- reduction, precipitation titration.

**UNIT III****(4 hrs)**

Method of gravimetric analysis, physical gravimetry, thermogravimetry and combustion analysis, precipitative gravimetric analysis, electrodeposition.

**UNIT IV****(4 hrs)**

**Complexometric titrations** Complexometric methods using EDTA, principle of complexometric titrations, chelating agents, indicators, titrations with disodium edetate.

#### UNIT V

(4 hrs)

**Nonaqueous titrations** General discussion and principle of titrations in non-aqueous media, aprotic, protophil protogenic and amphiprotic solvents. Titrations with perchloric acid, potassium methoxide and tetrabutyl ammonium hydroxide.

#### TEXT BOOKS

1. G.H. Jeffery, J. Bassett. J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5<sup>th</sup> ed., ELBS, U.K. 1989.
2. Keneth & A. Connors, A Text Book of Analysis, 3<sup>rd</sup> ed. Wiley interscience Singapore, 1982.
3. **e- book:** Pant D., Lab Manual Quantitative Analytical Method Book Rix Publication  
www.bookrix.com

#### REFERENCE BOOKS

1. Christian, Gary D. Analytical chemistry.-- New.Delhi: Wiley, 2004.
2. Shrivastava, M. L. Bioanalytical techniques.-- New.Delhi: Narosa, 2008.
3. Quevauviller P. and Thompson K. C., Analytical Methods for Drinking Water: Advances in Sampling and Analysis, John Wiley & Sons, Ltd. ISBN: 0-470-09491-5.
4. Harvey D. Modern Analytical Chemistry, McGraw-Hill Higher Education, New Delhi

**ENV 571 - Remote Sensing and GIS Lab**

**[2 Credits]**

**Course outcome: Skill development Laboratory**

**ENV 531 – Toxicology/Toxicity Laboratory**

**[2 Credits]**

**Course Objectives:** To provide the basic knowledge of toxic substance and involving Chemistry for its management

**Course Outcomes:** After completing this course, student is expected to learn the following:

**CO1:** Basic understanding of chemistry of toxic substance

**CO2:**Basic understanding of physical techniques involved for toxic substance

**CO3:**Basic understanding of food adulteration

**CO4:**Basic understanding of environmental toxicant

**CO5:**Development of the skills for the management

**CO6:**Skilldevelopment towards management

### **COURSE SYLLABUS:**

#### **UNIT 1: PRACTICAL EXPOSURE [Course Outcome (s) No. :1]**

- About the identification of toxic substance;
- Management techniques for toxic substance

#### **Unit 2:PHYSICAL PROPERTIES OF TOXIC [Course Outcome (s) No. :2]**

- Experiment based on physical properties of toxic substance on the basis of vapour pressure, vapour density and solubility

#### **Unit 3 IDENTIFICATION OF TOXIC SUBSTANCES IN FOOD SAMPLE. [Course Outcome (s) No. :3, 5 and 6]**

- Acids,
- Aldehydes
- Amines
- Dioxins
- Ethers
- Cyanides

#### **Unit 4 TOXICITY ISSUE [Course Outcome (s) No. :4, 5 and 6]**

- Arsenic
- Cadmium
- Lead
- Mercury
- Carbon monoxide

#### ***Suggested Readings:***

1. C. N. Madu, Environmental Planning and management, Imperial College Press, 2015.
2. Health Hazards of Environmental Arsenic Poisoning, Imperial College Press, 2014.
3. T. F. Yen, Chemical Processes for Environmental Engineering, Imperial College Press, 2013.
4. H. K. Moffatt and Shuckburgh, Environmental Hazards, Imperial College Press, 2011.
5. P. Patnaik, A Comprehensive Guide to the Hazardous Properties of Chemical Substances (3rd ed.) John Wiley & Sons, Inc., Hoboken, New Jersey, 2007.
6. C. Oloman, Material and Energy Balance for Engineers and Environmentalist, Imperial College Press, 2005.
7. L. C. Batty and K. B. Hallberg, Ecology of Industrial Pollution, Cambridge University press, New Delhi, 2004.

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed:

- To familiarize the students with fundamental right to clean environment and duties.
- The students will realize and underline the need for environmental legislations, and legislative powers of the Parliament.
- Students will acquire knowledge about different Environmental legislations at national level and conventions/protocols/treaties for conservation of Environment at international level.
- Students will learn about the Environmental legislation enforcement authorities, Environmental dispute redress bodies and the International Organizations for Conservation of Environment.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

7. Mid Term Examination: 25%
8. End Term Examination: 50%
9. Continuous Internal Assessment : 25%
  - d. Assignment: 10%
  - e. Class Test: 5%
  - f. Presentation: 10%

**COURSE CONTENT**

**UNIT (I)**

**1 hrs**

1. Introduction to Environmental Law, Powers of the Parliament to legislate Environmental legislations.
2. Status of Environmental legislations in India: Enumeration of Environmental legislations.

**UNIT (II)****4 hrs****Legislation enforcement authorities under:**

1. The **Environmental water (Prevention and Control of Pollution) Act, 1974 – composition, powers and functions.**
2. The Air (Prevention and Control of Pollution) Act, 1981 – composition, powers and functions.
3. The Environment (Protection) Act, 1986 – powers, EIA Notification, 2006.

**UNIT (III)****5 hrs****Environmental legislations and dispute redress bodies in India:**

1. The Wildlife (Protection) Act, 1972: Objectives, National Board for Wildlife (NBWL)
2. The Forest (Conservation) Act, 1980: Objectives and Mechanism.
3. The Biological Diversity Act, 2002: Objectives, National Biodiversity Authority.
4. National Green Tribunal- Composition and jurisdiction

**UNIT (IV)****2 hrs**

1. International Organizations for Conservation of Environment: UNEP, WWF, IUCN, IGBP.

**UNIT (V)****8 hrs****International Environmental Conventions, Protocols and Treaties:**

1. Ramsar Convention on Wetlands.
2. United Nations Conventions and Protocols on Climate Change, Ozone depletion, Biodiversity, Forest and Agenda -21.

**TEXTBOOKS**

1. Environmental Laws, 2005. Universal Law Publishing.
2. S.C. Santra, 2005, Environmental Science, New Central Book Agency (P) Ltd 8/1 Chintamani Das Lane, Kolkata- 700009

**REFERENCE BOOKS**

1. S. Diwan and A. Rosencranz, 2005, Environmental Laws and Policy in India.

2.Mallick, M. R. (Justice) 2010. Environmental Laws, Professional Book Publisher New Delhi

3.Rana S. V. S. 2005, Essentials of Ecology and Environmental Science, Prentice Hall of India Pvt. Ltd. New Delhi.

## ENV 564- Near Surface Geophysics

[4 Credits]

### Course Objective

The student will identify which geophysical methods are used by industry and academia to solve environmental problems, as most of the sub-surface methods are being used in geotechnical industry for characterizing the near surface sediments. The idea of having general exposure of students in mainly two geophysical techniques i.e. seismic methods (active and passive) and Ground penetration Radar so that they can have basic knowledge and about field configurations. The students will also be exposed to Instruments in the field as the University has Micro tremor system and 24 channel engineering seismograph. Under the specialized project the student will process the data using seismic data analysis software. The student will also summarize and critique recent publications in the fields of engineering and environmental geophysics.

### Course Goals and Outcome

Students should be able to:

- understand the fundamental concepts that result in the variation of seismic velocities and earth resistivity at or near the surface of the earth
- **Skill Development:**
  - to use various geophysical instruments including ground penetration radar, Seismic exploration for site characterisation and exploration, engineering seismometers (primarily for reflections and refraction surveys) both active and passive methods design, conduct and complete a total field project involving these methodologies
  - To be able to relate the interpretation of the geophysical information to local geology and structure.
  - Through a sequence of laboratory exercises in conjunction with intensive field projects the students learn by doing.
  - Besides learning the methodologies, the projects teach the students how to work in groups, both for data collection and analysis and interpretation and reporting.
- While there are tests, these are entirely "take home" requiring the students to work through processing and interpretation problems. These are designed to provide a foundation for the processing and interpretation of the information collected from the field projects.

### Attendance Requirement:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

### Evaluation Criteria:

- Mid Term Examination: 25%
- End Term Examination: 50%



- Continuous Internal Assessment : 25% (Breakup is following)

## Course Contents

### Unit I

Hazards definition of hazards, introduction to landslide hazard, earthquakes, flash floods and floods Himalayan orogeny, Structure and Tectonics of Himalaya.

Introduction to Applied Geophysics: what are applied and environmental geophysics, matching geophysical methods to applications, planning a geophysical survey, planning survey and survey constraints, survey design, optimum configuration

Introduction to Applied Seismology: Introduction, seismic waves, Raypath geometry in layered ground, reflection and refraction of obliquely incident rays, Critical reflection, diffraction, seismic energy source detection and recording of seismic waves, geophones and accelerometers, seismographs

### Unit II

Seismic Refraction Surveying: Introduction, General principles, Snell's law, Field survey arrangements, geometry of refracted ray paths, Interpretational methods, applications and case histories.

Seismic Reflection Surveying Introduction, reflection survey general considerations, reflection principles, reflection data processing (pre-processing, static correction, convolution and deconvolution, stacking, filtering and migration)

### Unit III

Introduction to Shear wave methods: Spectral analysis of surface waves (SASW); Continuous surface waves methods (CSWS) and Cross hole method

Multichannel analysis of surface waves (MASW), active and passive seismic methods, field configuration, optimum field configuration, source receiver geometry, data acquisition, data analysis using seismic software, dispersion analysis, data interpretation and its applications.

### Unit IV

Introduction to Ground Penetration Radar (GPR), Principle of GPR, , propagation of radiowaves, dielectric properties of earth material, modes of data acquisition, data processing, interpretational techniques and Applications of GPR

### Unit V

#### Site amplification:

What is site response, Site response studies, and application of MASW in site response, Shake analysis, its applications, Cases study, training of students in Geophysics and Surfer, SHAKE softwares

### Books Recommended:

1. **An introduction to applied and Environmental Geophysics by John M. Reynolds Wiley-Blackwell publications**
2. Principles of applied Geophysics by D.S.Parasnis **Springer publications**
3. Telford, W.M. et.al. Applied Geophysics: **Cambridge publication**
4. Geotechnical Earthquake Engineering by Sreven L. **Kramer**
5. Earthquakes (forecasting and mitigation by H.N. Srivastava
6. Recent advances in Earthquake geotechnical Engineering and microzonation by Atila Ansal, 2004

### ENV 557- Bio-resources and Environmental Biotechnology[4 Credits]

**Credits Equivalent:** 4 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

### Course Objectives and outcomes:

The course is designed to:

- Introduce concept of biotechnology and its role in development and sustainability
- Give in-depth knowledge and **skills** related to modern techniques in biotechnology.
- Give a brief concept how to improve our environment in future by using biotechnology.

### Attendance Requirement:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**UNIT I****10 hrs**

Bioresources- importance of bacteria, fungi as bioresources; their beneficial effect and mechanism of action; Introduction to Environmental biotechnology- definition, scope; role of biotechnology in development and sustainability.

**UNIT II****10 hrs**

Bioremediation: Environmental Xenobiotics and human health; principles of bioremediation; TOL plasmid pathway; aerobic and anaerobic microbial degradation processes; degradation of benzene, toluene, xylene, biphenyl and degradation pathways.

**UNIT III****12 hrs**

Recombinant DNA technology: Early discoveries, restriction endonucleases, ligases, modification enzymes, DNA and RNA markers, cloning and expression vectors (plasmids, bacteriophage, phagmids, cosmids, artificial chromosomes), selection of recombinant clones, CDNA synthesis and cloning (mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis, library construction and screening).

**UNIT IV****8 hrs**

Genetic engineering: Release of genetically engineered microorganisms, genetically modify corps-safety and environmental risks.

**Suggested Readings**

1. Comprehensive Biotechnology, Vol 4, M. Moo-young (Ed. InChief) pergamon, press, Oxford.
2. An Introduction to environmental biotechnology, AK Challerre, prentice Hall publication, New D elhi
3. An Introduction to Environmental Biotechnology by Milton Wainwright: Kluwer, Academic Press, 1999.
4. Environmental biotechnology theory and Application by G.M. Evans and J.C. Furlong, John Wiley and sons, 2004.

5. Environmental biotechnology, SK Agarval, APH publ. House, New Delhi-2006.
6. Mohapatra. P. K., 2006, Text Book of Environmental Biotechnology. I K International.
7. Waste water treatments (5th edition) M N Roa and A K Dutta, Oxford IBH Publ. Co. Pvt. Ltd., New Delhi-2003.
8. Rittman, B. E., and McCarty, P. L., 2001, Environmental Biotechnology. Principles and applications. McGraw-Hill, New York.
9. Olguin, E., Sanchez, G. and Hernandez, E., 1999, Environmental biotechnology and cleaner bioprocesses, Taylor & Francis, London.
10. Glazer AN, Nikaido H. (1994) Microbial Biotechnology – Fundamentals of Applied Microbiology, WH Freeman and Company, New York.
11. Bio-remediation Technologies, Technomic Publishing Co., USA. S.K. Sikdur& R.L. Irvine.

ENV 509

### **ENV 509- Glaciology [4 Credits]**

**Credit Equivalent:** 4 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to **develop skills of the students:**

1. Introduce the subject (Glaciology) to students and various approaches of glaciology, different variants of glacial systems and morphology and structures of glaciers.
2. Study glacial processes and associated landforms and their significance.
3. Understand glacial erosion and various hydrological processes
4. Make student acquainted with the Recent researches in the field of Glaciers and their use in water resources and palaeoclimatic studies

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - b. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

**UNIT I**

**(8 hrs)**

- Glaciology-an overview
- Approaches to Glaciology
- Glacier systems-
- Structure and morphology of glaciers

**UNIT II**

**(10 hrs)**

- Glacial erosion, Landscape evolution and different glacial landforms
- Mass balance and glacier dynamics
- Englacial and subglacial process

**UNIT III**

**(6 hrs)**

- Glacier hydrology dealing mainly with snow and melt water chemistry
- Glacier and water resources

**UNIT IV**

**(12 hrs)**

- Recent advances in Glaciology
- Glaciers and climate change
- Glacier Hazards
- Glaciers in relation to palaeoclimate studies

#### UNIT V

(4 hrs)

- Studies carried out on Indian Glaciers
- Indian efforts on Polar Research (Arctic and Antarctic scientific expeditions)

#### TEXT BOOKS

1. **Sharp R P 1988. Living Ice: Understanding Glaciers and Glaciations.** Cambridge University Press, ISBN 13 9780521330091.
2. **Hubbard B and Glasser N F 2005. Field Techniques in Glaciology and Glacial Geomorphology.** John Wiley & sons, Inc, ISBN 978-0-470-84426-7
3. **Bennett M M and Neil F. Glasser N F 2009. Glacial Geology: Ice Sheets and Landforms, 2nd Edition.** John Wiley & sons, Inc, ISBN: 978-0-470-51691-1

#### REFERENCE BOOKS

1. **Raina V K Glaciers the Rivers of Ice. Geological Society of India, ISBN 8185867739 (81-85867-73-9)**
2. **Hambrey M J and Alean J 2004. Glacial Environments. 2nd Edition Cambridge University Press, ISBN 0-521-82808- 2**
3. **David M. M and Attig J W 1999. Glacial Processes, Past and Present. Issue 337 of Special Papers Geological Society of America, ISBN 081372337X, 9780813723372**
4. **Knight P G 2009. Glacier science and environmental change. Wiley-Blackwell, ISBN 978-1-4051-9653-6**
5. **Cuffey and Paterson 2010. The Physics of Glaciers. 4th Edition, Academic Press, ISBN: 9780123694614**
6. **Fletcher N. The Chemical Physics of Ice. Cambridge Monographs on Physics, ISBN-13: 978-0521075978**

**Course Objectives:** To provide the basic knowledge of toxic substance and involving Chemistry for its management

**Course Outcomes:** After completing this course, student is expected to learn the following:

**CO1:** Basic understanding of chemistry of toxic substance

**CO2:** Basic understanding of physical techniques involved for toxic substance

**CO3:** Basic understanding of food adulteration

**CO4:** Basic understanding of environmental toxicant

**CO5:** Development of the skills for the management

**CO6:** Skill development towards management

### **COURSE SYLLABUS:**

#### **UNIT 1: PRACTICAL EXPOSURE [Course Outcome (s) No. :1]**

- About the identification of toxic substance;
- Management techniques for toxic substance

#### **Unit 2: PHYSICAL PROPERTIES OF TOXIC [Course Outcome (s) No. :2]**

- Experiment based on physical properties of toxic substance on the basis of vapour pressure, vapour density and solubility

#### **Unit 3 IDENTIFICATION OF TOXIC SUBSTANCES IN FOOD SAMPLE. [Course Outcome (s) No. :3, 5 and 6]**

- Acids,
- Aldehydes
- Amines
- Dioxins
- Ethers
- Cyanides

#### **Unit 4 TOXICITY ISSUE [Course Outcome (s) No. :4, 5 and 6]**

- Arsenic
- Cadmium
- Lead
- Mercury
- Carbon monoxide

### **Suggested Readings:**

8. C. N. Madu, Environmental Planning and management, Imperial College Press, 2015.
9. Health Hazards of Environmental Arsenic Poisoning, Imperial College Press, 2014.
10. T. F. Yen, Chemical Processes for Environmental Engineering, Imperial College Press, 2013.
11. H. K. Moffatt and Shuckburgh, Environmental Hazards, Imperial College Press, 2011.

12. P. Patnaik, A Comprehensive Guide to the Hazardous Properties of Chemical Substances (3rd ed.) John Wiley & Sons, Inc., Hoboken, New Jersey, 2007.
13. C. Oloman, Material and Energy Balance for Engineers and Environmentalist, Imperial College Press, 2005.
14. L. C. Batty and K. B. Hallberg, Ecology of Industrial Pollution, Cambridge University press, New Delhi, 2004.

## **ENV 524 - Environmental Impact Assessment**

**[2 Credits]**

### **UNIT – I**

Introduction to EIA, Purposes of EIA, Steps in EIA process, Hierarchy in EIA, Environment impact statement (EIS) and Environmental management plan, Impact indicators, Evolution of EIA, Evolution of EIA worldwide, Evolution of EIA in India, EIA Notification, 2006

### **UNIT – II**

EIA guidelines 1994, notification Govt of India, Forecasting Environmental Changes, Impact assessment methodologies, generalized approach to impact analysis, procedure for reviewing Environmental impact analysis and statement.

### **UNIT – III**

Guidelines for Environmental Audit, Introduction to Environmental planning, Base line information and Prediction (land, water, atmosphere and energy), Landuse policy for India.

### **UNIT – IV**

Urban Planning for india, Rural Planning and landuse pattern, concept and strategies of sustainable development, cost benefit analysis, Environmental priorities in India and sustainable development.

## **ENV 571 - Remote Sensing and GIS Lab**

**[2 Credits]**

Laboratory Experiments based on the course ENV 424 to be taught in Semester-II

## **ENV 411 – Waste Management**

**[2 Credits]**

### **UNIT I: Classification of waste**

Solid waste, liquid waste, Biodegradable and non biodegradable solid waste, Hospital and Pharmaceutical Waste, E-waste: Sources, generation, chemical composition, classification, Health hazards, Environmental impacts

### **UNIT II: Waste minimization technologies**



Framework for Solid Waste Management; Reuse/ recycling of Reuse and Recycling of different types of waste: Recycling of waste paper, plastics, landfill, other management techniques

#### **UNIT II:Waste Water Management**

Technological Options at Household Level Management, Kitchen Garden with Piped and without Piped Root Zone System, Leach Pit.

#### **UNIT IV:Technological Options at Community Level Management**

Sustainable technologies of waste management at Panchayat Level and local level; Case studies, opportunities in waste management.

### **ENV 573 -Water Resource Management**

**[2 Credits]**

#### **Unit I**

Brief outline of historic development, Water usage in evolution of history, Water Resources Development Scenario, Global and Indian Water Scenario

#### **Unit II**

World water resources: dimension and challenges, Hydrological cycle, Global water supply-demand management, Environmental impacts and water resource management

#### **Unit III**

Groundwater, structures of aquifers, Aquifer capacity, Determining aquifer flow velocity-Darcy Law  
Integrated water resource management (IWRM) and virtual water

#### **Unit IV**

Water harvesting techniques in hilly region, Artificial ground water recharge techniques and designs: artificial recharge techniques, direct methods, combination methods, ground water conservation techniques both modern and traditional, Snow harvesting, roof top harvesting and dew drop harvesting, Sustainable agriculture and irrigation

### **ENV 412- Analytical Technique**

**[2 Credits]**

#### **Course Objectives& outcome of the course:**

The course is designed to:

- Introduce students about different state of the art analytical techniques
- Discuss in details about different technical aspects of the instrumentation.
- Discuss the basic concept about the techniques and detailed applications

- Discuss in details about different trouble shooting of the instrumentation
- Give hands-on training so that they can apply and use the instrumentation and techniques in their future endeavor.

### **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in the examination.

### **UNIT I: Introduction to Chromatography**

Basic principle of Analytical techniques. Different types of Chromatography techniques and their applications. Thin layer Chromatography – Basic principle, methodology, application.

### **UNIT II: High Performance Liquid Chromatography**

Basic Principle, Methodology, Application. Discussion with examples based on published research papers.

### **UNIT III: Gas Chromatography**

Basic Principle, Methodology, Application. Discussion with examples based on published research papers.

### **UNIT IV: Liquid and Gas Chromatography - Mass spectrometry**

Basic Principle, Methodology, Application. Discussion with examples based on published research papers.

### **Suggested Readings**

1. Handbook of Thin-Layer Chromatography, 2003.3rd Edition; Edited By Joseph Sherma, Bernard Fried. CRC Press.
2. HPLC Basics- Fundamentals of LiquidChromatography (HPLC); Courtesy of Agilent Technologies, Inc.
3. Shimadzu fundamental guides to LC-MS
4. Agilent LC-MS primer
5. Waters HPLC-UHPLC notebook.
6. Principles of Gas Chromatography- Physical Methods in Chemistry and Nano Science Archer J.P. Martin and Anthony T. James. The Open Courses Library.

7. <https://bookauthority.org/books/best-chromatography-books>

### ENV 503 – Environmental Legislation: National & International

[2 Credits]

#### Unit I

Introduction to Environmental Law, Powers of the Parliament to legislate Environmental legislations. Status of Environmental legislations in India: Enumeration of Environmental legislations.

#### Unit II

The Environmental water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, The Environment (Protection) Act, 1986 – powers.

#### Unit III

The Wildlife (Protection) Act, 1972: Objectives, National Board for Wildlife (NBWL), The Forest (Conservation) Act, 1980: Objectives and Mechanism. The Biological Diversity Act, 2002: Objectives, National Green Tribunal- Composition and jurisdiction

#### Unit IV

Organizations for Conservation of Environment: UNEP, WWF, IUCN, Ramsar Convention on Wetlands, United Nations Conventions and Protocols on Climate Change, Agenda -21.

### ENV 564–Near Surface Geophysics

[2 Credits]

#### Course Objective

The student will identify which geophysical methods are used by industry and academia to solve environmental problems, as most of the sub-surface methods are being used in geotechnical industry for characterizing the near surface sediments. The idea of having general exposure of students in mainly two geophysical techniques i.e. seismic methods (active and passive) and Ground penetration Radar so that they can have basic knowledge and about field configurations. The students will also be exposed to Instruments in the field as the University has Micro tremor system and 24 channel engineering seismograph. Under the specialized project the student will process the data using seismic data analysis software. The student will also summarize and critique recent publications in the fields of engineering and environmental geophysics.

#### Course Goals and Outcome

Students should be able to:

- understand the fundamental concepts that result in the variation of seismic velocities and earth resistivity at or near the surface of the earth
- to use various geophysical instruments including ground penetration radar, Seismic exploration for site characterisation and exploration, engineering seismometers (primarily for reflections and refraction surveys) both active and passive methods

- design, conduct and complete a total field project involving these methodologies
- be able to relate the interpretation of the geophysical information to local geology and structure.
- Through a sequence of laboratory exercises in conjunction with intensive field projects the students learn by doing.
- Besides learning the methodologies, the projects teach the students how to work in groups, both for data collection and analysis and interpretation and reporting.
- While there are tests, these are entirely "take home" requiring the students to work through processing and interpretation problems. These are designed to provide a foundation for the processing and interpretation of the information collected from the field projects.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

- Mid Term Examination: 25%
- End Term Examination: 50%
- Continuous Internal Assessment : 25% (Breakup is following)

**Course Contents**

**Unit I**

Hazards definition of hazards, introduction to landslide hazard, earthquakes, flash floods and floods Himalayan orogeny, Structure and Tectonics of Himalaya.

Introduction to Applied Geophysics: what are applied and environmental geophysics, matching geophysical methods to applications, planning a geophysical survey, planning survey and survey constraints, survey design, optimum configuration

Introduction to Applied Seismology: Introduction, seismic waves, Raypath geometry in layered ground, reflection and refraction of obliquely incident rays, Critical reflection, diffraction, seismic energy source detection and recording of seismic waves, geophones and accelerometers, seismographs

**Unit II**

Seismic Refraction Surveying: Introduction, General principles, Snell's law, Field survey arrangements, geometry of refracted ray paths, Interpretational methods, applications and case histories.

Seismic Reflection Surveying Introduction, reflection survey general considerations, reflection principles, reflection data processing (pre-processing, static correction, convolution and deconvolution, stacking, filtering and migration

**Unit III**

Introduction to Shear wave methods: Spectral analysis of surface waves (SASW); Continuous surface waves methods (CSWS) and Cross hole method

Multichannel analysis of surface waves (MASW), active and passive seismic methods, field configuration, optimum field configuration, source receiver geometry, data acquisition, data analysis using seismic surfseis software, dispersion analysis, data interpretation and its applications.

#### Unit IV

Introduction to Ground Penetration Radar (GPR), Principle of GPR, , propagation of radiowaves, dielectric properties of earth material, modes of data acquisition, data processing, interpretational techniques and Applications of GPR

#### Unit V

##### Site amplification:

What is site response, Site response studies, and application of MASW in site response, Shake analysis, its applications, Cases study, training of students in Grapher and Surfer, SHAKE softwares

##### Books Recommended:

**1. An introduction to applied and Environmental Geophysics by John M. Reynolds Wiley-**

**Blackwell publications**

**2. Principles of applied Geophysics by D.S.ParasnisSpringer publications**

**3. Telford, W.M. et.al. Applied Geophysics: Cambridge publication**

**4. Geotechnical Earthquake Engineering by Sreven L. Kramer**

**5. Earthquakes (forecasting and mitigation by H.N. Srivastava**

**6. Recent advances in Earthquake geotechnical Engineering and microzonation by Atila**

Ansal, 2004

### ENV 557- Bio-resources and Environmental Biotechnology

[4 Credits]

#### UNIT I

Bioresources- importance of bacteria, fungi as bioresources; their beneficial effect and mechanism of action; Introduction to Environmental biotechnology- definition, scope; role of biotechnology in development and sustainability;

#### UNIT II

Bioremediation: Environmental Xenobiotics and human health; principles of bioremediation; TOL plasmid pathway; aerobic and anaerobic microbial degradation processes; degradation of benzene, toluene, xylene, biphenyl and degradation pathways.

### UNIT III

Recombinant DNA technology: Early discoveries, restriction endonucleases, ligases, modification enzymes, DNA and RNA markers, cloning and expression vectors (plasmids, bacteriophage, phagmids, cosmids, artificial chromosomes), selection of recombinant clones, cDNA synthesis and cloning (mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis, library construction and screening).

### UNIT IV

Genetic engineering: Release of genetically engineered microorganisms, genetically modify crops-safety and environmental risks.

## ENV 582 : Atmospheric Chemistry and Physics

[4 Credits]

### Unit I

Chemistry of Troposphere: Chemistry of Nitrogen in troposphere: Sources and chemistry of NO<sub>x</sub> and NO<sub>y</sub>, Chemistry of Sulphur in troposphere: Sources and chemistry of SO<sub>x</sub>, Chemistry of Carbon in troposphere: Sources and chemistry of CO, CO<sub>2</sub>, CH<sub>4</sub> and Non-methane Hydro Carbons, Chemistry of Oxygen in troposphere: ODD oxygen chemistry, formation of Ozone and OH\* radicals

Chemistry of Stratosphere: Chapman Mechanism for the Stratospheric Ozone Chemistry, NO<sub>x</sub> Cycles and HO<sub>x</sub> Cycles, Halogen Cycles, Reservoir Species and Coupling of the Cycles, Ozone Layer Depletion and Ozone Hole

### Unit II

Atmospheric Aerosols : Physical Properties of Atmospheric Aerosols, Chemical Composition of Atmospheric Aerosols, Interaction of light with particles, Role of Atmospheric aerosols in Global Climate Change

### Unit III

Atmospheric Thermodynamics: Gas Laws: Virtual Temperature, The Hydrostatic Equation: Geopotential, Scale Height and the Hypsometric Equation, The First Law of Thermodynamics: Joule's Law, Specific Heats, Enthalpy, Adiabatic Processes: Concept of an Air Parcel, The Dry Adiabatic Lapse Rate, Potential Temperature, Thermodynamic Diagrams, Water Vapor in Air: Moisture Parameters, Latent Heats, The Saturated Adiabatic Lapse Rate, Normand's Rule, Static Stability: Unsaturated Air, Saturated Air, Conditional and Convective Instability

### Unit IV

Atmospheric Radiative Transfer: Blackbody Radiation: The Planck Function, Wien's Displacement Law, The Stefan-Boltzmann Law, Kirchhoff's Law, The Greenhouse Effect, Physics of Scattering and Absorption and Emission: Scattering by Air Molecules and Particles, Absorption by Particles, Absorption and Emission by Gas Molecules, Radiative Transfer in Planetary Atmospheres: Beer's Law, Reflection and

Absorption by a Layer of the Atmosphere, Absorption and Emission of Infrared Radiation in Cloud-Free Air, Radiation Balance at the Top of the Atmosphere

#### Unit V

Atmospheric Dynamics: Dynamics of Horizontal Flow: Apparent Forces, Real Forces, The Horizontal Equation of Motion: The Geostrophic Wind, The Effect of Friction, The Gradient Wind, The Thermal Wind, The Atmospheric General Circulation, The Kinetic Energy Cycle: The Atmosphere as a Heat Engine

### ENV 404 - Energy and Environment

[2 Credits]

#### Unit I: Introduction to Energy and Environment

The concept of energy and environment, Sun as source of energy, Solar radiation and its spectral characteristics, Fossil fuels: definition, formation, classification, composition, physiochemical characteristics and energy content of coal, petroleum and natural gas.

#### Unit II: Sustainable Energy Resources

Concept of renewable and nonrenewable energy sources, Basic principles of generation of energy , Solar Energy: solar cells, solar concentrators, active and passive heating of buildings, green generators , Wind Energy: the concept of wind and air, types of wind mills and its parts, calculation of power produced by wind mills, Geothermal Energy: different sources of geothermal energy, direct and indirect uses, different types of geothermal electric plants, Energy from oceans: different types of ocean movements, energy from tides, currents and waves, OTEC: working and different types. Growing energy need, Energy use pattern and future need projection in different parts of the world and its impact on the environment.

#### Unit III: Green Technologies

Strengths for adopting Green Technology and Challenges for Green Technology Adoptions, Environmental implication of energy use: exponential increase in energy consumption and projected future demands, CO<sub>2</sub> emissions, global warming. Environmental degradation due to energy production and utilization, Concept of Green Buildings: design, energy efficiency, sustainability etc.

#### Unit IV Recent advances

Introduction to internal combustion engines: two stroke and four stroke engines, its efficiency, recent developments in IC engines, Recent developments in transportation sector: Electric, hybrid and solar powered vehicles, other green technologies: hydroponics, water efficient irrigation systems, Smart grids, Farm automation etc.

### ENV 443–Basics of Climate Change (SD)

[2 Credits]

#### Unit I The Climate System: an overview

- Weather Vs Climate,

- Components of the Climate System,
- The Driving Forces of Climate,
- Climate Parameters and Data-sets available to study Climate Change,
- Observed Natural Vs Anthropogenic Climate Change

**Unit II:** Human and Natural Drivers of Climate Change:

- The Sun and The Earth Geometry,
- Milankovitch Cycles, Solar Constant,
- The Effect Temperature of the Earth,
- Green House Effect,
- The concept of Radiative Forcing and Climate Sensitivity

**Unit III:** Radiative effects of Aerosol and Gases:

- Greenhouse gases
- Halocarbon radiative forcing
- Radiative forcing due to stratospheric ozone changes
- Tropospheric Aerosols: Direct forcing due to Sulphate aerosols and Soot aerosols, Indirect forcing due to effect of aerosols on cloud properties,
- Stratospheric Aerosols

**Unit IV:** Observations of Changes in Climate:

- Atmospheric Changes: Instrumental Record,
- Changes in the Ocean: Instrumental Record,
- Changes in the Cryosphere: Instrumental Record,
- A Palaeoclimatic Perspective,
- Extreme Weather Events

## **Semester- IV**



**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed for skill development of students:

- Understand different natural and manmade disasters
- Explore the reason of its origin and the possible antidotes so that it can dwindle to some extent.
- Implement environmentally sound strategies in this concern

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

4. Mid Term Examination: 25%
5. End Term Examination: 50%
6. Continuous Internal Assessment : 25% (Breakup is following)
  - d. Assignment/Quiz/Term Paper: 20%
  - e. Presentation/Seminar/Field work: 20%
  - f. Practical: 60%

**Course Contents:**

**Unit-1:**

**4 hrs**

- **Introduction to Disaster Management**
- Farmer curve showing significance and frequency of different natural disaster
- Scope and Objectives of Disaster Management
- Disaster Managers

- Elements of Disaster Management

Assignment-1: To prepare historical archive of Cyclone for last 20 years and their disastrous effects

Assignment-2: To prepare historical archive of Flood disaster in India for the last fifty years and their disastrous effect

## Unit 2:

4 hrs

- Concepts and Terms in Disaster Management
- Natural Disasters
- Man-made Disasters
- Disaster Victim
- Disaster Relief Systems
- Phases of Disaster Response
- Phases of Relief Operations
- Case study of Kashmir Flood 2014.

Assignment -3: list different earthquake of Himalayan region with their magnitude and explain the disastrous effect of 1905 Kangra earthquake

**Unit-3** The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters : *Case study of earthquake disaster and landslide disaster* 4 hrs

Assignment-4 Write down about Yokohama strategy and plan of action for the safer world

## Unit-4

4 hrs

- **The Tools and Methods of Disaster Management**
- Prevention and Mitigation Tools
- Preparedness Tools
- Tools of Post-Disaster Management
- Case studies

Assignment -5: write down different methods to be used for mitigation of landslide and earthquake disaster as a preparedness part of disaster management cycle.

## Unit-5

4 hrs

- **Technologies of Disaster Management**
- Mapping
- Aerial Photography and Remote Sensing
- Communications

- Information Management
- Logistics
- Epidemiology

### Suggested Readings:

#### Material prepared by teachers and the following reference will be useful

1. **Harsh K. Gupta**, (2004): Disaster management, **Universities Press**, ISBN: 9788173714566
2. **R.B. Singh**, (2000): Disaster Management, **Rawat Publication**, New Delhi.
3. **H.K. Gupta** (2003): Disaster Management, **Universities Press, India**, ISBN: 9788173714566
4. **Satender**, (2003): Disaster Management in Hills, **Concept Publishing Co., New Delhi**, ISBN: 9788180690143
5. **Bhandani, R.K.**, (2000): An overview on Natural & Manmade Disaster & their Reduction, **CSIR, New Delhi**.
6. **Gupta**, (2001): Manuals on Natural Disaster management in India, National Centre for Disaster Management, IIPA, New Delhi, 2001

### Env 428- Himalayan Geology

[2 Credits]

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Aim:** The main thing is to introduce the student to concepts and applications of geophysics to solving environmental and engineering problems.

#### **How course activities and course structure help students achieve these goals:**

The course is designed to give them the background knowledge and **skills** using several methods in order to encourage them to think about the utility of geophysics in the solution to problems of an environmental nature. The student will also summarize and critique recent publications in the fields of Himalayan geology.

#### **Course Objective**

The course is intended to provide a holistic approach to study the surficial features and the processes with emphasis on Himalayan region. The subject will serve as a dynamic and physical based account of the processes at planets surface with an integrated approach involving the principles of geomorphology and sedimentology. The student will deal with different aspects of Himalayan Geology and how Himalaya has been originated and formed. How they have been shaped to the present form. The student will analyze and integrate the physical features, field methodology, and interpretation of structural and tectonic features to conclude how Himalaya

has been formed.

**Course Outcomes: Skill Development**

- The student will understand how Himalayan has been formed
- Learning about different river system how they have been originated from Himalayan and why Himalaya is named as Third pole.
- Will understand different rock type and how they have been formed and what the relationship between different rock types is.
- What is the role of tectonics in generating earthquake in Himalayan region?
- How sediments are deposited and how river are changing their course after years and what could be their consequences.
- Learning about the sedimentary flux: origin, transport and deposition.
- Learning about the geomorphic and sedimentological processes related to fluvial, coastal, aeolian, and glacial regimes.
- Learning about the environmental changes and its impact on surface processes and landforms.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

- 4. Mid Term Examination: 25%
- 5. End Term Examination: 50%
- 6. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course content**

Unit-1 Introduction, importance and significance of Himalaya, their morphology, What is faults, folds, their definitions and their types and classifications.

**4 hrs**

Unit-2 Internal structure of Earth, Internal structure of Earth, fundamental characteristics of crust, mantle, core; fundamentals on rock-forming minerals; weathering and erosion of rocks and minerals. Concept of plate tectonics, types of plate boundaries, features of convergent and divergent boundaries, causes of plate motion, dynamic evolution of continental and oceanic crust, Sea floor spreading, morphological features of ocean floor.

Assignment:1 a) What do you understand by continental drift theory? Explain its pros and cons  
b) What do you understand by plate tectonic theory and how this theory supports the formation of Himalaya

**4 hrs**

Unit-3 Sedimentary rocks their types and classification, metamorphic rocks their classifications. Geosynclines: Classification and evolution of Geosyncline, causes of subsidence and upliftment. **4 hrs**

Assignment: 2 What do you understand by sedimentary rock and metamorphic, how they are formed and explain their texture with example.

Unit-4 Origin of Himalaya, different phases in evolution of Himalaya. Study of major groups and formations of Himalaya, lithology and thrust boundaries – HFF (Himalayan frontal fault), MBT(main boundary thrust), MCT( main central thrust), STD(south Tibetan detachment), indo-Tsangpo suture zone. **4 hrs**

Assignment 3: Draw neat and clean Geological Time Scale

Unit-5 Earth's Earthquake seismology, palaeoseismology, seismites, Seismology: seismic waves, intensity and isoseismic lines, earthquake belts. Earthquake zones of India, Seismograph, causes of earthquake in Himalaya. **2 hrs**

**Recommended Books**

1. Condie, K.C. (1984). Plate Tectonics & crustal Evolution. Pregamon Press, London.
2. A.K., Biyani, (2007), Dimensions of Himalayan Geology.
3. Earth: Introduction to Physical Geology, Fifth addition. Prentice Hall Pub.
4. The Geology of earthquake by Robert Yeats, Kerry Sieh and Clarence R. Allen Oxford University Press.
5. Geology of India and Burma M.S. Krishnan 1968 addition, Higginbothams (p) limited
6. Earthquake ( forecasting and mitigation) by H.N. Srivastava , National Book Trust, India

**Courses offered before 2020**

Course Code	Name of the course	Credit	Level	Prerequisite	Co – requisites
ENV121	Basics of Environmental Studies	2	1		For BSC
ENV122	Environmental Issues and Policies	2	1		For BSC
ENV 401	Introduction to Ecology	2	4		
ENV 402	Introduction to Earth Processing	2	4		
ENV 402a	Introduction to Earth Processes	2	4		
ENV 403	Environmental Chemistry	4	4		ENV 402
ENV 404	Energy and Environment	2	4		

ENV 405	MountainEcology	4	4		ENV 401
ENV 406	Water resources and water pollution	2	4		ENV 402
ENV 407	Soil Sciences and soil pollution	2	4		
ENV 408	Biodiversity and wildlife Management	2	4		ENV 401
ENV 409	Environmental Microbiology	2	4		ENV 410
ENV 410	Environmental Biotechnology	2	4	ENV 403	ENV 401/409/411
ENV 411	Waste Management	2	4		ENV 407
ENV 412	Analytical Techniques	2	4		
ENV 413	Natural Resource Conservation	4	4		ENV 401
ENV 414	Computer Applications and Statistical Techniques	4	4		ENV 423
ENV 415	Application of Remote Sensing & GIS in Natural Resource Management	4	4		ENV 402A
ENV 416	Introductory Environmental Economics	2	4		
ENV 417	Radiation and Environment	2	4		ENV 402/403
ENV 418	Ecology Lab	2	4		ENV 402/517
ENV 419	Geosciences Lab	2	4		ENV 401/402
ENV 420	Fundamentals of MountainEcology	2	4		
ENV 421	Municipal Solid Waste Management	2	4		ENV 411
ENV 422	Basics of Natural Resource Conservation	2	4		ENV 401
ENV 423	Basics of Computer Applications and Statistical Techniques	2	4		ENV 401/402
ENV 424	Fundamentals of Remote Sensing	2	4		ENV 401/402
ENV 425	Application of Remote Sensing &	2	4		ENV 402

	GIS				
ENV 427	Life cycle and Waste Projection	2	4		ENV 411/413
ENV 428	Himalayan Geology	2	4		
ENV 429	Himalayan Ecology	2	4		
ENV 430	Environmental Biology	2	4		
ENV431	Environmental Data Analysis	4	4		
ENV432	Introduction to Statistical Techniques	4	4		
ENV433	Computer applications in Environmental Sciences	4	4		
ENV434	Fundamentals of Ecology and Environment	4	4		
ENV435	Environmental Sciences Laboratory – I	2	4		
ENV436	Environmental Sciences Laboratory – II	2	4		
ENV437	Earthquake awareness	2	4		
ENV 438	Environment and Society	2	4		
ENV 439	Principles of Biodiversity and Wildlife Conservation	2	4		
ENV 440	Microbes and sustainable development	2	4		
ENV 441	Water resource Conservation in Hilly Region	2	4		
ENV 442	Adaptation of Climate change	2	4		
ENV 443	Basics of climate change	2	4		
ENV 501	Environment Pollution and Human Health	2	5	ENV 406/407	ENV 417
ENV 502	Natural Hazard and	4	5		

	Disaster Management				
ENV 503	Environmental Legislation National and International	2	5		
ENV 504	Field work and Dissertation	4	5		
ENV 505	Ecological Engineering	4	5		
ENV 506	Environmental Movements	4	5		
ENV 507	Traditional Knowledge and Environmental conservation	4	5		
ENV 508	Environmental Ethics	2	5		
ENV 509	Glaciology	4	5	ENV 420	
ENV 510	Applications of Mathematical Modelling & Ground Water Management	4	5		
ENV 511	Rain Water Harvesting and Artificial Recharge in Hilly Region	4	5		
ENV 512	Documentation and Management of Invasive Species	4	5		
ENV 513	Inventorization of species	4	5		
ENV 514	Energy uses and its implications for H.P. State	4	5		
ENV 515	International Environmental Policies	4	5	ENV 406/407	
ENV 516	Atmospheric Science	2	5		
ENV 517	Earth System Science	2	5	ENV 402	
ENV 518	Environmental Technology and Governance	2	5		
ENV 519	Biogeography	2	5		
ENV 520	Geo Informatics	2	5		
ENV 521	Geo Engineering	2	5		
ENV 522	Ecosystem Diversity	4	5	ENV 401/408	ENV 512
ENV 523	Toxic and Hazardous	4	5	ENV 411	



	Waste Management				
ENV 524	Environmental Impact Assessment	2	5		
ENV 525	Environmental Geochemistry	2	5		
ENV 526	Soil Fertility and farmland Geology	2	5		
ENV 527	Environmental Toxicology	2	5	ENV 411	ENV 523
ENV 528	Nanotechniques and Environment	2	5	ENV 412	ENV 523/410
ENV 529	Green Chemistry and Environment	2	5	ENV 412	
ENV 530	Analytical Techniques for Air, Water, Soil and Plant Lab	4	5	ENV 412	
ENV 531	Toxicology lab	2	5	ENV 412	
ENV 532	Industrial Training/Field Work/project	4	5		
ENV 533	Micrometeorology and Plant Productivity	2	5	ENV 516	
ENV 534	Green Technologies and Market	2	5	ENV 529	
ENV 535	Natural Hazard	2	5	ENV 402/517	
ENV 536	Disaster Management	2	5	ENV 402/517	ENV 535
ENV 537	Environmental Engineering	2	5		
ENV 538	Impacts of Environmental Movements	2	5		
ENV 539	Indigenous Traditional Knowledge and Environmental conservation	2	5		
ENV 540	Water Harvesting in Hilly Regions	2	5		ENV 510
ENV 541	Techniques of Artificial Water Recharge in Hilly Regions	2	5		
ENV 542	Documentation of Exotic Species	2	5		

ENV 543	Documentation of Native Species	2	5		
ENV 544	Methods and Technology of Inventorization of species	2	5		
ENV 545	Fundamentals of Energy Budgeting	2	5		
ENV 546	Renewable and Non-Renewable Energy Potential In HP State	2	5		
ENV 547	Contemporary Environmental Issues	2	5	ENV 406/407/417	
ENV 548	Introduction to Environmental Impact Assessment	2	5	ENV 402/517/	
ENV 549	Advances in Environmental Impact Assessment	2	5		
ENV 550	Microbial Ecology	2	5		
ENV 551	Ecosystem Dynamics	2	5		
ENV552	Analytical Technique (Physical Science)	2	5		
ENV 553	Environmental Thermodynamics	2	5	ENV 403	
ENV 554	Environmental Conservation and sustainable development	4	5		
ENV 555	Emerging ethical issues for Nano Technology in Environment	2	5		ENV 528
ENV 556	Carbon cycling and its management in the environment	2	5	ENV 403	
ENV 557	Bio-resources and Environmental Biotechnology	4	5		
ENV 558	Applied Microbiology	4	5		
ENV 559	Environmental Geophysics	2	5	ENV 402/517/521/424/425/535/536	ENV 521
ENV 560	Meteorology and Climatology	4	5		
ENV 561	Science of Climate Change	4	5	ENV 402/560/517/	
ENV 562	Analytical	2	5		

	Techniques (Biological Sciences)				
ENV 563	Earth Science and its Processes	4	5		
ENV564	Near Surface Geophysics	4	5		
ENV565	Sustainable Technologies	4	5	ENV534	
ENV566	Introduction to Marine Environment	4	5		
ENV567	Environmental Monitoring and assessment	4	5		
ENV568	Environmental Pollution and Environmental Engineering	4	5		
ENV569	Environmental Pollution and Health issues	4	5		
ENV570	Microbial Technology and Sustainable Development	4	5		
ENV571	Remote sensing and GIS lab	2	5		
ENV572	Land use planning	2	5		
ENV573	Water resource management	2	5		
ENV574	Bio Analytical Techniques	4	5		
ENV575	MSC Dissertation	6	5		
ENV576	Introduction to environmental system analysis	2	5		
ENV577	Carbon management	2	5		
ENV578	Introduction to Glaciology	2	5		
ENV 579	Recent trends in Environmental Biotechnology	2	5		
ENV 580	Recent trends in Glaciology	2	5		
ENV 581	Methods in Scientific Research	4	5		
ENV 582	Atmospheric Chemistry and	4			

	Physics				
ENV 583	Soil Science	2			
ENV 584	Oceanography	4			
ENV 599	Dissertation (M.Phil.)	20	6		
ENV 601	Geochemistry – Biogeochemical Cycles	4	6		
ENV 602	Spectroscopy and Chromatography Techniques	4	6	ENV 412	ENV 403
ENV 603	Advances in ecology and environment	4	6		
ENV 604	Earth Systems Dynamics and Processes	4	6		
ENV 605	Traditional and Contemporary Waste Treatment technologies	4	6	ENV 41	ENV 523
ENV 606	Geomorphology	4	6		
ENV 607	Site amplification	2	6		
ENV 608	Seismology	2	6		
ENV 609	Environmental Xenobiotics- source, distribution and health effect	4	6		
ENV 610	Applied biotechnology and Bioremediation	4	6		
ENV 611	Atmospheric Chemistry	2	6		
ENV 612	Application of GPR	4	6		
ENV 613	Atmospheric Physics	2	6		
ENV 614	Advanced Waste Management Techniques	2			
ENV 615	Advance Microbial Technologies	2			
ENV 616	Advance Bioremediation Techniques	2			
ENV 617	Research Methodologies in Natural Sciences	4			
ENV 699	Thesis (Ph.D.)	60	6		

