



teri school of
advanced studies

**Darbari Seth Block, India Habitat Centre
New Delhi**

**MINUTES OF THE EIGHTH MEETING OF THE ACADEMIC
COUNCIL HELD ON MONDAY, 24 NOVEMBER 2003, AT
11.00HOURS IN THE CONFERENCE ROOM**

PRESENT:

The following members of the Academic Council attended the meeting:

- | | | |
|-----|----------------------|---|
| 1. | Dr T P Singh | Chairperson |
| 2. | Dr Vibha Dhawan | Dean, Faculty of Applied Sciences |
| 3. | Dr Y P Abbi | Head, Centre for Energy and Environment |
| 4. | Dr Ligia Noronha | Head, Centre for Regulatory & Policy Research |
| 5. | Dr Meeta Mehra | Head, Department of Natural Resources |
| 6. | Dr D K Banerjee | |
| 7. | Prof. Brij Gopal | |
| 8. | Dr S C Adlakha | |
| 9. | Dr P Paradha Saradhi | |
| 10. | Dr Subodh K Sharma | |
| 11. | Dr Abha Agnihotri | |
| 12. | Dr Sanjay Saxena | |
| 13. | Dr Vidya S Batra | |
| 14. | Mr Rajiv Seth | Secretary |

Prof. Subhash Chander attended the meeting as a Special Invitee.

Dr Neeraj Khara, Dr Nandini Kumar, Dr S Sreelesh Mr Sanjay Upadhyay and Mr Vivek Kumar attended the meeting as course coordinators.

Dr Leena Srivastava, Dr Alok Adholeya, and Dr A K Gosain regretted their inability to attend.

Prof. N S Kambo, Dr Arvind Virmani, Dr S R Rao, Dr Ranjan Bose and Dr T S Panwar could not attend.

Item No. 1 To confirm the minutes of the seventh meeting of the Academic Council held on 23rd July 2003

The minutes of the seventh meeting of the Academic Council held on 23rd July 2003 were confirmed, as circulated.

Item No. 2 To report the matters arising from the seventh meeting of the Academic Council held on 23rd July 2003

The Academic Council was briefed on the progress for selection of three new faculty members to be appointed in the School. The applications are being screened by a screening committee and the short-listed candidates will be sent letters for interviews shortly.

Item No. 3 To consider and approve M.Sc programmes courses NRS 122, NRS 132, NRS 162, NRS 172 and NRS 142 and Pre-Ph.D. courses RPR-272, RPR-236 and RPR-242.

The courses for the second semester of M.Sc (Environmental Studies) and M.Sc (Natural Resources) as well as three new Pre-Ph.D. courses in the Centre for Regulatory Policy and Research, were discussed by the Council. The following points emerged:

(a) General:

- (i) It was brought out that all M.Sc courses should have a uniform system of evaluation. It was decided that 50% of the evaluation would be based on the major test (including aspects of practicals/laboratory work), 30% would be devoted to two minor tests; the remaining 20% would cater for class participation, seminars, assignments etc.
- (ii) It was suggested that once these courses have stabilised after being offered a few times, material on some of these new courses should be compiled and brought out as a publication of the School.

(b) NRS 162: Basics of Watershed Science

It was suggested that more practicals be introduced in the course, especially in the area of watershed management. An overview of watershed activities in the country needs to be included in the syllabus. The amended course outline is placed at annexure 3.1.

(c) **NRS 172: Tools for Natural Resource Management**

It was decided to change the name of the course to “Geomatics for Natural Resource Management”. The amended course outline is placed at annexure 3.2.

(d) **NRS 142: Environmental Law and Policy**

It was suggested that laws related to climate change and global environment change be introduced in the course. In addition to forest policy, policies related to other natural resources such as water, soil etc. need to be introduced. The Council suggested that the course should include the evolution of environmental law and development of institutions to give students a preparatory background. The amended course outline is placed at annexure 3.3.

(e) **NRS 132: Environmental Pollution and Control**

The Council decided that more practicals need to be introduced in the course. More lectures need to be added on the ‘Control’ aspects of environmental pollution. The credit scheme of the course to be changed to 3-0-1. The amended course outline is placed at annexure 3.4.

(f) **NRS 122: Silviculture & Forest Measurements**

The Council approved the course. The course outline is placed at annexure 3.5.

(g) **RPR 272: Research Methods**

The Council approved the course. The course outline is placed at annexure 3.6. After discussion it was decided that in the next academic session, research methods relating to applied sciences would be added to the course, if necessary by making it a 3-credit course. It was also suggested that this course be made compulsory for all Ph.D students.

(h) **RPR 236: Introductory Course on Climate Change**

The Council approved the course. The course outline is placed at annexure 3.7. In view of the large number of faculty involved in the teaching of this course, it was suggested that the course coordinator be responsible for evaluation.

Dr Subodh Sharma suggested that Mr Vivek Kumar follow up with him for additional thoughts/ suggestions that he might have for the course.

(i) **RPR 242: Globalisation: Challenges for Development and Policy Making**

The Council approved the course. The course outline is placed at annexure 3.8.

Item No. 4 To consider and recommend names of outside experts for constitution of Selection Committee for appointment of new faculty.

A list of outside experts, in the three areas in which new faculty is to be appointed, is placed at annexure 4.1. This list was recommended by the Council for approval by the Board of Management.

The meeting ended with a vote of thanks to the Chair.

Course No:	NRS162
Course title:	Basics of Watershed Science
Number of credits:	4 (2-1-1)
No of lectures-tutorial-practical:	40-0-30
Faculty:	Dr. S Sreekesh

Course outline

This course seeks to introduce the concepts of watershed science and its application in management of natural resources. It would introduce the basic concepts and principles of watershed to the students. It would also provide an understanding of the basic methods and techniques to measure and analyze different watershed parameters. The course would provide the students with an overview of planning, implementation, monitoring and evaluation of watershed development activities and consequent changes. The course would enable the students to analyze, from a watershed management perspective, resource management issues and problems affecting natural resource use and conservation and thus the sustainable development.

Evaluation procedure

- 2 minor tests: 20 %
- Practical/assignments: 15 %
- One term paper: 15 %
- 1 major test (end semester): 50 %

Details of course content & allotted time

Topic	Allotted time (h)		
	L	T	P
Basic principles			
Introduction to watershed science–concept and definition; its importance in emerging water scenario (world and India)	2	0	2
Rationale for watershed approach; components of watershed – water, land, and biotic (both human and non–human)	1	0	0
Landscape defining processes - Climatology, hydrology, geology and soil; spatial and temporal changes in processes	2	0	0
Characteristics of watershed - Size, shape, slope, topography, drainage, land use etc. and its implications – comparative analysis	2	0	4
Hydrological cycle in watershed: - Precipitation, interception, evaporation, transpiration, infiltration, runoff, storage (reservoirs and ground water), transfer, and their behaviour in watershed; Properties of hydrological cycle, portions affected by societal interventions	4	0	0
Precipitation - Types and characteristics, extreme events Average depth over area; Depth-area-duration relation Rainfall-runoff relationship	2	0	4
Evaporation and transpiration - Factors affecting evaporation and transpiration in a watershed; Actual and potential evapotranspiration; Measurement and estimation of evaporation and transpiration	2	0	4
Streams - Drainage pattern and density, River thalweg, Stream ordering	2	0	4

Topic	Allotted time (h)		
	L	T	P
Runoff - Watershed factors affecting runoff; Measurement and estimation of runoff; Water yield; Hydrograph	2	0	4
Water balance – Estimation; Importance in watershed development	2	0	4
Land in watershed - Landscape approach, geomorphology; Soil survey, soil erosion and its types, soil loss equation; Methods to control soil erosion;	3	0	2
Biotic elements - Vegetation patterns; Land use patterns, Land capability; Calculating water use for different agricultural methods	2	0	0
Socio-economic factors - Demographic profile; Sociological factors Land tenure system and property rights; Resource access and equity	2	0	0
Water harvesting, water conservation, and management, measures in a watershed	2	0	0
Watershed change			
Agents and causes of change in watershed—both natural and human induced	1	0	0
Effects of humans and livestock; Changes of concern	1	0	0
Watershed management			
Concepts and framework of watershed development and management	2	0	0
Elements of integrated watershed management;	1	0	0
Criteria for prioritizing watershed for development	1	0	0
Monitoring and evaluation approaches for watershed management projects and programs;	1	0	2
Socio-economic-institutional elements and challenges of watershed management;	1	0	0
Multiple uses and limited resources of watershed; Prioritization of watershed for development Challenges faced by communities and resource managers; Case studies of watershed management	2	0	0

Basic textbooks

1. *Paranjape, S., Joy, K J., and et all 1998 Watershed based development: a source book.* Bharat Gyan Vigyan Samithi, New Delhi
2. Andy D Ward and William J Elliot. Ed 1995 **Environmental Hydrology** Lewis Publishers New York
3. Peter E Black 1996 **Watershed Hydrology**, Lewis Publishers, London

Suggested reading

1. Ray K Linsley, Max A Kohler, and Joseph L H Paulhus **Applied Hydrology**
2. Rajesh Rajora. 1998 **Integrated watershed management** Rawat publishers, Jaipur
3. *Purandare A P and A K Jaiswal 1995 Watershed development in India.* National institute of rural development, Hydrabad
4. J V S Murty. 1994 **Watershed Management.** New age international publishers, New Delhi
5. FAO 1986 **Strategies, approaches, and systems in integrated watershed management**

Course No:	NRS172
Course title:	Geomatics for Natural Resource Management
Number of credits:	4 (2-0-2)
No. of lectures-tutorial-practical:	27-0-58
Faculty:	Dr. S Sreekesh

Course outline

The course will cover basic concepts of map reading, remote sensing, GPS and fundamentals of GIS. The section on GIS concentrates on spatial data inputs, its manipulation, and spatial analysis using different methods. The remote sensing section consists of physics of remote sensing, image interpretation elements, and image enhancement and classification techniques. The GPS section will cover the working principles of GPS and its use.

This theory and techniques presented in this course will be extended to cover applications in natural resources and environmental management.

Evaluation procedure

- 2 minor tests: 20 %
- Practical: 15 %
- One GIS/RS project: 15 %
- 1 major test (end semester): 50 %

Details of course content & allotted time

Topic	Allotted time (h)		
	L	T	P
<i>Fundamentals of maps</i>			
Basics of map reading, marginal information of maps, types and sources of map, cartographic representation of data, map coordinate system, projections and their types, and guidelines for preparing a base map, thematic mapping.	3	0	2
<i>Global Positioning Systems (GPS)</i>			
Introduction to the GPS functions	2	0	0
Field operation of GPS and data collection using GPS	0	0	2
<i>Remote sensing</i>			
Physics of remote sensing: Electro magnetic spectrum and spectral signatures	2	0	0
Types of remote sensing, Platforms and sensors; active and passive sensors; aerial photographs, satellite images, radars; sensor characteristics	2	0	2
Resolution- spatial, spectral, radiometric and temporal,	1	0	2
Image interpretation - Elements and methods –			
Visual and digital	1	0	4
Basics of digital image processing	1	0	2
Image correction –geometric	1	0	2
Digital image enhancement techniques (stretching, filtering)	2	0	4
Classification: supervised and unsupervised	2	0	4

Topic	Allotted time (h)		
	L	T	P
Application of remote sensing techniques in resource and environment management–case studies	0	0	4
Geographical Information System			
Basic concepts and components of GIS; Feature types	2	0	0
Spatial data models (raster & vector) - their advantages and disadvantages;	2	0	0
Spatial data creation and management- methods, topology creation, editing and manipulation, attaching attribute data	2	0	8
Spatial analysis: single and multiple layer spatial analysis	3	0	8
Spatial querying; arithmetic and logical operations,	1	0	4
Spatial data visualization –map design and layout for thematic layers and display of tables and graphs using GIS software.	0	0	4
Application of GIS in Environment and resource management	1	0	4

Basic textbooks

- 1) *Muehrcke, P.C.* 1992. **Map use: Reading, analysis and interpretation**
- 2) *Burrough, P A* 1998 **Principles of geographical information system**, Oxford: Oxford University Press.
- 3) *Lillesand, Thomas M* 2003 **Remote sensing and image interpretation**, New York: John Wiley & Sons.

Suggested reading

- 1) *Chou, Yue-Hong.* 1997 **Exploring spatial analysis in geographical information systems** , OnWord Press, USA
- 2) *Bernhardsan, T.* 1992. **Geographical information system** Viak IT, Norway
- 3) *Fotheringham, S., Ed* 1994 **Spatial analysis & GIS** Taylor & Francis, London
- 4) *Morain, Stan. Ed.* 1999 **GIS solutions in natural resources management: Balancing the technical-political equation.** OnWord Press, San Fe
- 5) Christopher Jones. 2002 **Geographical information systems and computer cartography** Longman, London
- 6) Lo, C.P., Albert K.W.Yeung. 2002 **Concepts and techniques of geographic information systems** Prentice Hall,
- 7) *Richards John A* 1999 **Remote sensing digital image analysis: An introduction** Berlin: Springer
- 8) Michael A. Wulder and Steven E. Franklin Eds 2002 **Remote sensing of forest environments: Concepts and case studies.** Kluwer Academic Publishers

Course No.:	NRS142
Course title:	Environmental Law and Policy
Number of credits:	4 (3-1-0)
Number of lectures-tutorial-practicals:	42-14-0
Course coordinator:	

Course outline

This course would introduce the vast field of Environmental Law and Policy including an introduction to the International Environmental Law regime and the judicial process. The course would be divided into three broad categories. The first part would cover the basic concepts and principles of Environmental Law under the broader environmental jurisprudence discourse. This would include judicial precedence, which now forms an essential part of environmental jurisprudence. The second part would be divided into specific introductory modules on forests and wild life including bio-diversity related laws; Air and Water related laws including mega projects and marine laws; and Environment Protection Laws. The third part would discuss in two sub parts the new international environmental law developments and how a common citizen would relate to environmental law including the legal tools available for sustainability of environment. At the end of the course the students would be familiar with the overall Environmental Law and Policy regime of the country as well as its international obligations. The case studies as well as the section on practical relevance of environmental law would equip them with basic knowledge and skills to understand environmental law issues.

Evaluation procedures

- 2 minor tests: 20%
- 1 major test (end semester): 50%
- Term paper: 15%
- Class participation: 5%

Details of course content & allotted time

Topic	Allotted time (h)	
	L	T
Basic Concepts in Environmental Law. <ul style="list-style-type: none"> ▪ Original development of environmental law in India, advent of PIL, liberalisation of rule of <i>locus standi</i> before higher courts ▪ Introduction to environmental law along with basic legal terminology and concepts, which is frequently encountered in environmental law discourse. ▪ Environmental law and the Indian Constitution. ▪ Overview of legislations including basic concepts in tort, crime, property. ▪ Law as an effective tool for environment protection. 	5	2
Module 1 – Forest, Wildlife and Biodiversity related laws <ul style="list-style-type: none"> ▪ Evolution and Jurisprudence of Forest and Wildlife laws. ▪ Statutory framework on Forest, Wildlife and Bio-Diversity eg. IFA, 1927, 	1 4	2

Topic	Allotted time (h)	
	L	T
WLPA, 1972, FCA, 1980, Biodiversity Act, 2002 <ul style="list-style-type: none"> ▪ Forest policy and Joint Forest Management ▪ Wildlife Trade ▪ Biodiversity Act ▪ Strategies for conservation – Project Tiger, Elephant, Rhino, Biosphere Reserves ▪ Role of courts 	1 1 1 1	
Module II – Air, Water and Marine Laws <ul style="list-style-type: none"> ▪ National Water Policy ▪ Laws relating to prevention of pollution, access and management of water. ▪ Jural principles and strategies on water rights. ▪ Ground water and law ▪ Inter-state water disputes, river pollution and the law. ▪ Judicial remedies and procedures ▪ Marine laws of India ▪ Legal framework on Air pollution ▪ Role of courts in prevention of Air pollution 	1 1 1 1 1 1 2 1 1	2
Module III – Environment protection laws and Mega projects <ul style="list-style-type: none"> ▪ Common law and environment protection, evolution of judicial principles in environment protection ▪ Legal framework on environment protection-Environment Protection Act as the framework legislation – strength and weaknesses including Public Liability Insurance Act, National Environment Tribunal Act and National Environment Appellate Authority Act <ul style="list-style-type: none"> - EIA - Procedural laws-consent, siting, location - Hazardous wastes - Authorities and environment protection ▪ The courts and environment protection <ul style="list-style-type: none"> - Judicial aggression on pollution control - Judicial restraint on infra structure projects - Nuisance and environment protection ▪ Environment and trade 	2 3 3 1	2
International Environmental law <ul style="list-style-type: none"> ▪ Evolution of international environmental law ▪ Customary international law, Global conferencing, Common but differentiated responsibility, Polluter pays. ▪ Role of UNEP Environmental Law Unit ▪ International Legal Regime on Forest, Wildlife and Biodiversity 	1 1 1 1	2

Topic	Allotted time (h)	
	L	T
<ul style="list-style-type: none"> ▪ International law and water pollution ▪ Air pollution and international law <ul style="list-style-type: none"> - Montreal Protocol, - Kyoto Protocol ▪ International law on environment protection <ul style="list-style-type: none"> - Climate Change 	1	
<p>Environmental law and you</p> <ul style="list-style-type: none"> ▪ Forest and wildlife offences and prosecution; nature of offence, Trial; Complaint; exhibits; arrest, seizure, search; seizure memo, FIR, diary, Evidence ▪ Citizens' suit provision, PILs, ▪ Public hearing in India 	2	2
Term Paper		4

References

1. Divan S. and Rosencranz A; 2001; **Environmental law and policy in India. 2nd edition-Cases, materials and statutes.**
2. Upadhyay S and Upadhyay V.; 2002; **Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment;** Vol I; Lexis Nexis- Butterworths-India.
3. Upadhyay S and Upadhyay V.; 2002; **Hand Book on Environmental Law- Water Laws, Air Laws and the Environment;** Vol II; Lexis Nexis- Butterworths-India.
4. Upadhyay S and Upadhyay V.; 2002; **Hand Book on Environmental Law- Environment Protection, Land and the Energy Laws;** Vol III; Lexis Nexis- Butterworths-India.
5. Desia Ashok A; 2002; **Environmental jurisprudence; Modern law house.**
6. Guha R.; 2000; **Environmentalism, a global history,** Oxford university press.
7. Singh C.; 1986; **Common property and common poverty.** Oxford University Press.
8. Guruswami I. *et. al.*; 1994; **International Environmental Law and World Order- A Problem Oriented Case Book;** West Publication Company.
9. Servai H.M.; 2002; **Constitutional Law of India in 3 volumes;** Universal Book Traders.
10. Gadgil M. Guha R.; 1995; **Ecology and Equity.** Penguin books.

Course No.:	NRS 132
Course title:	Environmental Pollution and Control
Number of credits:	4 (3-0-1)
No. of lectures-tutorial-practicals:	42-0-28
Course coordinator:	Dr. Nandini Kumar

Course outline

The course is designed to build upon the background given in the first semester of the basic chemistry of the natural environment. This will be used to describe the causes, effects and control of pollution caused by anthropogenic interferences. Apart from a study of the basic pollution to air, soil and water, the concept of hazardous waste, landfill management will also be introduced.

Evaluation procedure

- 2 minor tests: 15%+15%
- 1 major test (end semester): 50%
- Practicals: 10%
- Assignments/seminar: 10%

Details of course content and allotted time

Topic	Allotted time (h)	
	L	P
Air pollution Types of air pollutants (gaseous and particulate): Sources, control, distribution and health effect of CO, SO ₂ , NO _x , HCs and photochemical oxidants, particulate matter, ozone.	6	Analysis of particulate matter for heavy/trace metals 6
Air quality monitoring, measurement and standards (CO, SO ₂ , NO _x , HCs, particulate matter, ozone, oxidants)	4	Field trip to local environmental monitoring laboratories, CPCB etc. 6
Indoor air quality: pollution and control (formaldehyde, nitrogen dioxide and carbon monoxide, asbestos, radioactivity from radon gas)	2	
Water pollution Criteria of water quality, water quality parameters (physico-chemical and biological)	2	Determination of BOD/COD in water samples 8
Classification of water pollutants (organic and inorganic) Water quality standards: rationale for setting standards	2	
Detergents (composition, pollution caused by non-phosphate formulations, control)	1	
Oil (chemical composition of petroleum, sources of oil pollution, fate and effect of oil spills, control)	2	
Pesticides (chlorinated HCs, chlorophenoxy acids,	3	

Topic	Allotted time (h)	
	L	P
organophosphates, carbamates, effects and control)		
Toxic metals: sources, impact and control	3	
Oxygen-demanding wastes: sources, treatment and control	3	Field trip to sewage treatment plant
Pollution of marine environment (oil, sewage, persistent organic compounds, trace metals radioactivity): sources, impact and control	3	8
Land and soil pollution		
Control: waste reduction and minimization	3	
Physical methods of waste treatment, biodegradation and composting, recycling	2	
Landfill management	3	
Hazardous waste		
Radioactive waste: sources, impact, storage, disposal and control	3	

Basic textbooks

1. S E Manahan *Fundamentals of Environmental Chemistry*
2. A K De *Environmental Chemistry*

Suggested reading

1. R A Horne *The chemistry of our environment*
2. R M Harrison *Pollution: causes, effects and control*, Fourth edition
3. J E Andrews *An introduction to environmental chemistry*

Course No.:	NRS122
Course title:	Silviculture & Forest Measurements
Number of Credits:	4 (3-0-1)
No. of lectures-tutorial-practicals:	42-0-28
Course coordinator:	Dr. Neeraj Khera

Course outline

The course is designed to give the students knowledge of various techniques used for the regeneration, tending and measurement of forest trees. Study of silvicultural characteristics of a few important Indian tree species will help them to understand the suitability of silvicultural techniques to each species.

Evaluation procedure

- 2 minor tests: 15%+15%
- 1 major test (end semester): 50%
- Practicals: 20%

Details of course content & allotted time

Topic	Allotted time (h)		
	L	T	P
Introduction: definition and scope of silviculture, tree classification. Distinguishing features of tree and forest	1		
Natural regeneration: Seed production, dispersal, germination and establishment; regeneration survey, technique of obtaining natural regeneration of important species; natural regeneration from vegetative parts; natural regeneration from coppice	4		
Artificial regeneration: Essential preliminary considerations; seed source, collection, processing, testing, presowing treatments, seedling growth and survival Introduction to the techniques of Tissue culture, clonal propagation etc.	5 5		12 (Seed collection, testing, Presowing treatments, seedling growth; tissue culture techniques)
Nursery techniques: Classification; nursery site, fencing, layout; Nursery techniques-preparation of bed, pre-germination, seed specifications, weeding, shading, irrigation, transplanting, plant containers, root trainers	3		A visit to a local nursery, and forest department will be organised for the students
Management of plantation site: Soil preparation, fencing, method of planting, pattern of planting, quantity of planting material, spacing, irrigation, Nurse crop, cover crop, weeding, protection, economics of Plantation site management	2		A visit to a plantation site will be organised for the students
Afforestation techniques: Objectives, Afforestation of different type of areas including denuded hill slopes, shifting sands, canal banks, road side stripes, saline alkaline soils, laterite soils and ravine lands,	5		

Topic	Allotted time (h)		
	L	T	P
energy plantations; economics of afforestation			
Tending operations: Weeding, cleaning, thinning, improvement felling, girdling, pruning, climber control	2		
A brief introduction to Silvicultural systems: Clear-felling system; The uniform system; The group system; The Shelterwood system, The selection system, The coppice system, Conversions.	2		
Silviculture of some important Indian trees: <i>Acacia spp.</i> , <i>Bamboo spp.</i> , <i>Casuarina equisetifolia</i> , <i>Dalbergia sissoo</i> , <i>Eucalyptus spp.</i> , <i>Pinus roxburghii</i> , <i>Populus spp.</i> , <i>Shorea robusta</i> , <i>Taxus baccata</i> , <i>Tectona grandis</i>	6		4 (Identification of seeds and timber)
Societal impacts of silvicultural practices, Current problems in stand management and forest regeneration in India; Silvicultural techniques being practiced in different countries	2		
Measurement of Tree diameter, Girth and height: Standard rules governing tree measurements, instruments used, diameter and girth classes, relation between diameter and girth, Methods of measuring height, principles for measurement, height classes	1		6
Measurement of tree volume and Biomass: Volume of felled tree, volume of standing tree, volume table, preparation of general and local volume table, simulation models	2		2
Determination of Age and Growth of Trees: Methods of age determination, age determination of standing tree, age of felled tree, Classification of increment, CAI and MAI, increment percent, Stump analysis, Stem analysis, increment boring	2		4

Basic textbooks

1. Khanna, L. S. 1999. *Principles and Practice of Silviculture*. Natraj Publications, Dehradun.
2. Chaturvedi and Khanna. 2000. *Forest Mensuration and Biometry*. Natraj Publications, Dehradun
3. Ram Prakash and Khanna. 1991. *Theory and Practice of Silvicultural Systems*. Natraj Publications.

Suggested reading

1. Troup, R. S. *Silviculture of Indian Trees*
2. A. P. Dwivedi. 1992. *Principles and Practices of India Silviculture. First ed.* Surya Publications, DehraDun

Course No.:	RPR272
Course title:	Research Methods
Number of credits:	2 (2-0-0)
Number of lectures-tutorial-practicals:	28-5-0
Course coordinator:	Dr. Ligia Noronha

Course outline

This course is available to all research students at the TERI School. The aim of the course is to create a background and awareness of the nature of the research process and inquiry. It will expose the student to some of the methodological problems encountered in interdisciplinary research. The course will provide a comprehension of basic principles of research design and strategy, including an understanding of how to formulate researchable problems. It will introduce students to a wide range of research methods, quantitative and qualitative – and will review study approaches for combining multiple methods within a single research project. It will discuss the benefits, the appropriateness, and challenges of the qualitative and the quantitative traditions in ENRM research. This course is geared towards preparing doctoral students for their research work by focusing on the relative strengths and weaknesses of various data collection and interpretation techniques. The course will also cover questions surrounding the politics and ethics of research in social sciences. The course will have 3 main modules: Philosophy and social methodology, research design and methods, and research ethics.

Module I

Philosophic and theoretical perspectives

This module is an effort to reflect on the presuppositions of science and social science. Even as it yields to an idea of context as central to what science and social science are and can be, the challenge is to broaden our reasoning about the scientific enterprise as a whole,

- a. Explanation and understanding in science and social science. **4**
 Can the study of humans and society be scientific in the same manner as the study of natural objects? Can we speak of a unified science, or should natural science inquiry and social science inquiry be viewed as two basically different activities? How are we to cross-cut the distinction between 'explanation' as characteristic of natural science and 'understanding' as endemic to social science?
- b. Science, knowledge and power **2**
 Context of discovery and context of justification in the philosophy of science and epistemological inquiry; on the "will to knowledge" or the project of epistemology and its refiguration.
- c. Concepts of action, structure, agency, and process. **2**
 Prioritising concepts for social science by addressing precisely the problem of context, while focusing in particular on the concepts of action, structure, agency and process as a means of answering the more dynamic question: "How do people acquire knowledge and skills?"

Module II

Research Design and Methods

a. Defining the Research Problem and hypotheses

What is a Research Problem? Selecting the Problem; Hypotheses; types of hypotheses; Differences between hypothesis & research problem;

b. Elements of research design:

Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research to Research Design; Different Research Designs; Developing a Research Plan.

c. Sampling

- Why sample?; Definition of population-sample; Sampling designs; Factors determining sample size; Sampling errors and Generalizability.

D . Quantitative methods of data collection.

- Data processing and analysis; Functions of statistics in social research; Descriptive and inferential statistical methods; Measures of central tendency, dispersion and asymmetry; Measures of correlation and simple regression analysis; Testing of hypotheses-parametric and nonparametric methods; Introduction to Multivariate analysis techniques;
- Interpretation
Meaning of Interpretation; Why Interpretation? Technique of Interpretation; Precautions in Interpretation; and interpretation based on case data

d. Qualitative methods of data collection.

In contrast to quantitative approaches, the qualitative approach is defined as one that typically uses purposive sampling and semi-structured or interactive interviews to collect data and analyzes it through sociological or anthropological research techniques such as ethnographic, PRA, Process Documentation Research (PDR) and PAR. In the course, students are exposed briefly to the appropriateness of these research approaches as well as their limitations and critiques. In this segment, students also learn more about the case study method of research and the principle of grounded theory, that seeks to inductively build a theory that is derived from the social phenomenon that it represents.

e. Interdisciplinary methodologies in ENRM research

This module will introduce students to the importance of understanding the interaction of global, national and regional processes with the ecological and social characteristics of particular places and sectors; the methodologies used in ENRM research; why this is particularly necessary today; what are the challenges that environmental and natural resource problems pose?; the importance of balancing various interests in community based ENRM; the use of multi-criteria analysis; the emerging research programme in sustainability science

Module III**Research ethics**

This module will be concerned with the ethics of data collection, the ethics of the treatment of human subjects, and the interaction of science with society

Course content, faculty and time

No.	Topic	Faculty	Allotted time (hrs) (L-T-P)
1	Philosophic and theoretical perspectives	Sasheej Hegde	8-0-0
2	Defining the Research Problem and hypotheses	K S Nairy	2-0-0
3	Elements of research design	K S Nairy	2-0-0
4	Sampling	K S Nairy	2-0-0
5	Quantitative methods of data collection	K S Nairy/Ranjan Bose	6-2-0
6	Qualitative methods of data collection	Vishal Narain	4-2-0
7	Interdisciplinary methodologies in ENRM research	Ligia Noronha	2-1-0
8	Research ethics		2-0-0
Total			28-5-0

Course No:	RPR 236
Course title:	Introductory Course on Climate Change
Number of credits:	2 (2-0-0)
No. of lectures-tutorials-practicals:	27-1-0
Course coordinator:	Dr. Vivek Kumar

Course outline

This course will provide an introduction to climate system and its inter-relationship with different ecosystems, human systems, and socio-economic systems. The course will discuss causes of climate changes, natural as well as anthropogenic and its impacts on different systems. The course will also cover the response measures to combat climate change both at implementation as well as at policy level and will provide background to the climate change convention process and the emerging flexibility mechanisms. The course will also cover the inter-linkages of the UNFCCC with other international conventions.

Course content

Topic	Allotted time (hrs)	Faculty
Introduction to climate system	7	Dr Vivek Kumar
Structure of earth's atmosphere and energy balance, greenhouse effect, greenhouse gases and aerosols	2	Dr Vivek Kumar
Past climatic changes	1	Dr Vivek Kumar
Anthropogenic activities and rising concentration of GHGs in the atmosphere, inventory of GHGs – ALGAS, NATCOM and others	2	Dr Vivek Kumar
Climate modeling, leading world labs on climate change, their models and projections	2	Dr Vivek Kumar
Consequences of climate change	6	
Sea level rise, vulnerability of coastal areas and island states, water resources and glacier retreat, case studies from India & S. Asia	3	Dr Ligia Noronha
Agriculture, forestry, biodiversity, human health, infrastructure, industry etc., case studies from India & S. Asia	3	Dr Vivek Kumar
Policy responses to climate change	6	
IPCC, its establishment, purpose, reports so far and climate change projection	2	Dr R K Pachauri
UNFCCC, its evolution, objective, highlights of various CoPs, Kyoto Protocol, CDM, Marrakesh Accords and Delhi Declaration, Evolution of Indian negotiating stance	4	Amb. C Dasgupta
Community responses to climate change	6	
Mitigation of climate change, clean and energy efficient technologies, CDM benefits	2	Mr Vivek Kumar
Sequestration of GHGs, LULUCF and CDM benefits,	2	Mr Varghese Paul

Topic	Allotted time (hrs)	Faculty
Adapting to climate change, case studies, integration of traditional wisdom with climate change policy responses	2	Dr Vivek Kumar
Linkages of UNFCCC with other international conventions such as CBD, CCD, Ramsar Convention, MDG	2	Ms Els Reynaers
Term-paper presentation by students⁺	1	Dr Vivek Kumar

Suggested reading

Module 1

- Houghton, John T.; 1997; *Global Warming: The Complete Briefing*; Cambridge University Press
- Ruddiman, W.F.; 2000; *Earth's Climate: Past and Present*; W H Freeman & Co.
- Hardy, John; 2003; *Climate Change: Causes, Effects and Solutions*; John Wiley & Sons
- *Climate Change 2001: The Scientific Basis*; from Working Group 1 of the IPCC
- <http://www.doc.mmu.ac.uk/aric/gccsg/4-1.html>
- Henderson Sellers, A & K McGuffie (1996) *A Climate Modeling Primer*. Chichester : Corley, (2nd Edition)

Module 2

- Mintzer, I.M.; 1992; *Confronting Climate Change: Risks, Implications and Responses*; Cambridge University Press
- Hardy, John; 2003; *Climate Change: Causes, Effects and Solutions*; John Wiley & Sons
- *Climate Change 2001: Impacts, Adaptation and Vulnerability*; from Working Group 2 of the IPCC
- Lonergan, S. 1998; *Climate warming and India*; In *Measuring the Impact of Climate Change on Indian Agriculture*, edited by A Dinar, et al. Washington DC: World Bank. [World Bank Technical Paper No. 402]
- Ravindranath N H and Sukumar R.; 1998 *Climate change and tropical forests in India*; *Climatic change* 39(2-3): 563-581
- TERI; 1996; *The Economic Impact of a One Metre Sea Level Rise on the Indian Coastline: method and case studies*; Report submitted to the Ford Foundation
- <http://www.teriin.org/climate/impacts.htm>

Module 3

- *Climate Change 2001: The Scientific Basis*; from Working Group 1 of the IPCC
- *Climate Change 2001: Impacts, Adaptation and Vulnerability*; from Working Group 2 of the IPCC
- *Climate Change 2001: Mitigation*; from Working Group 3 of the IPCC
- *Negotiating the CDM: a North-South perspective: Recommendations on the Draft Negotiating Text for COP-6*; TERI and The Pembina Institute for Appropriate Development. 2000
- Gupta, S. and Bhandari P.; 2000; *CDM and its Implications for Developing Countries*; In *Climate Policy and Development – Flexible Instruments and Developing Countries*; edited by Axel Michaelowa and Michael Dutschke; Edward Elgar Publishing Limited, UK

- Bhandari P., Gupta S, Pachauri R.K., Srikanth S.B., Srivastava L.; 1999; Climate of Concern: Bridging the Divide; Tata Energy Research Institute
- Pathak M., Srivastava L., and Sharma S.; 1999; CDM Opportunities and Benefits in India; In Opportunities for Financing Sustainable Development via the Clean Development Mechanism; edited by D Austin and P Faeth; World Resources Institute, Washington, DC
- http://unfccc.int/resource/iukit/infokit_02_en.pdf
- <http://unfccc.int/resource/docs/convkp/conveng.pdf>
- <http://unfccc.int/resource/docs/convkp/kpeng.pdf>
- <http://unfccc.int/resource/guideconvkp-p.pdf>
- http://unfccc.int/resource/beginner_02_en.pdf

Module 4

- Climate Change 2001: Impacts, Adaptation and Vulnerability; from Working Group 2 of the IPCC
- Climate Change 2001: Mitigation; from Working Group 3 of the IPCC
- Gupta, S. and Bhandari P.; 2000; CDM and its Implications for Developing Countries; In Climate Policy and Development – Flexible Instruments and Developing Countries; edited by Axel Michaelowa and Michael Dutschke; Edward Elgar Publishing Limited, UK
- Pathak M., Srivastava L., and Sharma S.; 1999; CDM Opportunities and Benefits in India; In Opportunities for Financing Sustainable Development via the Clean Development Mechanism; edited by D Austin and P Faeth; World Resources Institute, Washington, DC
- <http://www.teriin.org/reports/rep152/rep152.htm>
- http://www.natcomindia.org/presentations/cc_impacts.pdf
- <http://unfccc.int/cop7/issues/lulucf.html>
- http://www.ieta.org/Documents/Discussion_Papers/IETA_discussion_paper_0202.PDF

Module 5

- http://unfccc.int/resource/iukit/infokit_02_en.pdf
- <http://unfccc.int/resource/guideconvkp-p.pdf>
- <http://www.unu.edu/inter-linkages/eminent/papers/WG2/Sanwal.pdf>
- <http://www.geic.or.jp/climgov/index.html>

Module 6

As per the selected topics

The reading list should be further supplemented by current articles in standard journals.

Course No:	RPR 242
Course title:	Globalisation: challenges for development and policy-making
Number of credits:	2 (2-0-0)
No. of lectures-tutorials-practicals:	26-2-0
Course coordinator:	Dr. Meeta K. Mehra

Course outline

The course will be offered to Ph.D. students in the Centre for Regulatory and Policy Research, Faculty of Policy and Planning. The course aims at understanding better as to how globalisation poses a significant economic, social and environmental challenge, especially for developing countries. By focusing on developmental issues surrounding the debate on economic globalisation, it covers aspects relating to its implications for inequality and poverty, environmental degradation, labour standards and cultural homogenisation. It covers aspects relating to political implications of differentiated growth in the country and enhanced uncertainty due to competition and dependence on economic state of other countries. It also focuses on the opportunities that globalisation offers in the form of higher rates of economic growth, technology diffusion, and dissemination of knowledge. The course also covers aspects of domestic policy and institutional responses towards globalisation. The study of relevant theoretical models and empirical trends puts the debate in perspective and highlights the lack of consensus as to the linkages between globalisation and development and challenges for policy making.

Course contents

Introduction

What do we mean by globalisation? Issues and debates surrounding definition of globalisation -- faster flow of information, freer international goods trade, freer capital mobility, easier movement of persons; Empirical evidence to corroborate the above.

Overview of issues surrounding the globalisation debate

Globalisation and economic growth; Globalisation, poverty and inequality; Threat to employment and wages; Implications for labour migration and labour standards; Cultural homogenisation; Threats to democracy; Threat to environment; Globalisation and gender;

Globalisation and implications for domestic economic, social and environmental policies.

History of globalisation and development

Phases of globalisation and its implications -- previous waves of globalisation (including historical aspects of globalisation in pre-British India), their reversal (history of trade protectionism in western countries); New wave of globalisation; Empirical evidence on globalisation and poverty reduction; East Asian miracle and Washington consensus; social protest movements; world social forum.

International trade

Why do countries trade? Sources of comparative advantage – technology, factor endowments, preferences, and economies of scale; Trade restrictions – second best arguments for trade protection, political economy of trade protectionism; Regionalism versus multilateralism; Links among international trade, industrialization and poverty; Trade as an engine of growth (East Asian Miracle).

Role of WTO, Decision making process and bargaining in the WTO; Dispute settlement mechanism in the WTO; G-20 at Cancun; Domestic negotiating capacity and response strategies towards

multilateralism; implications for trade and development policy in developing countries and on domestic competition and firm turnover; Social protection in globalised economies.

Capital mobility and financial crises

Short term flows of financial capital versus direct foreign investment; Causes of international capital movement; Debt problem; Financial and political power of Multinational Corporations (MNCs). Fixed and floating rate regimes; Exchange rate determination – interest rate, capital mobility and volatility; Case studies in financial crises (e.g., in South East Asia, Latin America); Implications, sustainability and consequences of India's rising foreign exchange reserves.

Role of the IMF; How is the Washington Consensus changing? Domestic competition and investment policy regimes.

Technology transfer and Intellectual Property Rights (IPR) issues

Enabling environment for transfer of technology and IPRs; Intellectual property rights and the incentives to invest abroad; MNCs and technological diffusion; Potential of drugs (issues of compulsory licensing); Genetically modified food (pros and cons).

Response of domestic patent and IPR regimes to international patents and IPR regulation.

Environment

Trade-off between present and future generations; Is the current pattern of growth sustainable? Empirical evidence on the consequences of openness to trade on environment – revisit the pollution haven debate; Is there a race to the bottom in environmental standards? Do multilateral environmental agreements conflict with trade provisions of WTO? Trade and environment in the WTO regime (SPS & TBT agreements, Tuna-Dolphin case, Shrimp-Turtle case, EC-Asbestos case).

Is globalisation reducing multi-functionality of ecosystems such as wetlands? Is this likely to increase the vulnerability of communities to other global changes such as global environmental change?

Responses of national environmental policies and regulation to dynamics of globalisation.

	Topic	L	T	P
1.	Introduction	2		
2.	Overview of issues surrounding the globalisation debate	4		
3.	History of globalisation and development	3		
4.	International trade	5	1	
5.	Foreign capital mobility and financial crises	4		
6.	Technology transfer and Intellectual Property Rights (IPR) issues	3		
7.	Environment	5	1	

List of readings

1. Krugman, Paul and Obstfeld, Maurice. *International Economics – Theory and Policy*. Sixth Edition. Addison Wesley 2003.
2. *Globalisation, Growth and Poverty: Building and inclusive world economy*. A co-publication of the World Bank and Oxford University Press, Oxford University Press, New York, 2002.
3. Stiglitz, Joseph, *Globalisation and its discontents*, Penguin Books, 2002.
4. Ray, Debraj, *Development economics*, Oxford University Press, 1998.
5. Rodrik, Dani, *Has globalisation gone too far?* Institute for International Economics, 1997.

6. Rodrik, Dani. *Making openness work: the new global economy and the developing countries*. Overseas Development Council, Washington D.C., 1999
7. Globalisation and its critics, *The Economist*, September 29, 2001
8. Eswaran, Mukesh and Kotwal, Ashok., *Why poverty persists in India*, Oxford University Press, 1994.
9. Diamond, Jared, *Guns, Germs and Steel*. Norton, 1999.
10. Rosenberg, Nathan; Birdzell, L. E., Jr. *How the west grew rich? The economic transformation of the industrial world*. New York Basic Books, 1986.
11. www.wto.org
12. <http://commerce.nic.in/wtomatters.htm>
13. The South Asia Development and Cooperation Report 2001/02, Research & Information Systems for Non-aligned and Other Developing Countries (RIS), New Delhi, India.

