

**1.3.1 Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum**

**B. A. (Hons.) Political Science**

**GENDER SENSITIZATION**

**7. Women, Power and Politics**

**Course objective:** This course opens up the question of women's agency, taking it beyond 'women's empowerment' and focusing on women as radical social agents. It attempts to question the complicity of social structures and relations in gender inequality. This is extended to cover new forms of precarious work and labour under the new economy. Special attention will be paid to feminism as an approach and outlook. The course is divided into broad units, each of which is divided into three sub-units.

**I. Groundings (6 weeks)**

1. Patriarchy (2 weeks)  
a. Sex-Gender Debates  
b. Public and Private  
c. Power

2. Feminism (2 weeks)

3. Family, Community, State (2 weeks)  
a. Family  
b. Community  
c. State

**II. Movements and Issues (6 weeks)**

1. History of the Women's Movement in India (2 weeks)

2. Violence against women (2 weeks)

3. Work and Labour (2 weeks)

a. Visible and Invisible work  
b. Reproductive and care work  
c. Sex work

**Reading List**

**I. Groundings**

**1. Patriarchy**

Essential Readings:

T. Shinde, (1993) 'Stree Purusha Tulna', in K. Lalitha and Susie Tharu (eds), *Women Writing in India*, New Delhi, Oxford University Press, pp. 221-234

U. Chakravarti, (2001) 'Pitrasatta Par ek Note', in S. Arya, N. Menon & J. Lokneeta (eds.) *Naarivaadi Rajneeti: Sangharsh evam Muddey*, University of Delhi: Hindi Medium Implementation Board, pp.1-7

**a. Sex Gender Debates**

Essential Reading:

V Geetha, (2002) *Gender*, Kolkata, Stree, pp. 1-

20 **b. Public and Private**

### **7.Feminism: Theory and Practice**

**Course Objective:** The aim of the course is to explain contemporary debates on feminism and the history of feminist struggles. The course begins with a discussion on construction of gender and an understanding of complexity of patriarchy and goes on to analyze theoretical debates within feminism. Part II of the paper covers history of feminism in the west, socialist societies and in anti-colonial struggles. Part III focuses a gendered analysis of Indian society, economy and polity with a view to understanding the structures of gender inequalities. And the last section aims to understand the issues with which contemporary Indian women's movements are engaged with.

#### **I. Approaches to understanding Patriarchy (22 Lectures)**

- Feminist theorising of the sex/gender distinction. Biologism versus social constructivism
  - Understanding Patriarchy and Feminism
  - Liberal, Socialist, Marxist, Radical feminism, New Feminist Schools/Traditions

#### **II. History of Feminism (22 Lectures)**

- Origins of Feminism in the West: France, Britain and United States of America
- Feminism in the Socialist Countries: China, Cuba and erstwhile USSR
- Feminist issues and women's participation in anti-colonial and national liberation movements with special focus on India

#### **III. The Indian Experience (16 Lectures)**

- Traditional Historiography and Feminist critiques. Social Reforms Movement and position of women in India. History of Women's struggle in India
- Family in contemporary India - patrilineal and matrilineal practices. Gender Relations in the Family, Patterns of Consumption: Intra Household Divisions, entitlements and bargaining, Property Rights
- Understanding Woman's Work and Labour – Sexual Division of Labour, Productive and Reproductive labour, Visible - invisible work – Unpaid (reproductive and care), Underpaid and Paid work, - Methods of computing women's work, Female headed households

#### **Essential Readings**

##### **I. Approaches to understanding Patriarchy**

Geetha, V. (2002) *Gender*. Calcutta: Stree.

Geetha, V. (2007) *Patriarchy*. Calcutta: Stree.

Paper II: Women's Writing

1. Emily Dickinson 'I cannot live with you'  
'I'm wife; I've finished that'  
Sylvia Plath 'Daddy'  
'Lady Lazarus'  
Eunice De Souza 'Advice to Women'  
'Bequest'
2. Alice Walker *The Color Purple*

11

24  
2/2/2017

12

3. Charlotte Perkins Gilman 'The Yellow Wallpaper'
- Katherine Mansfield 'Bliss'
- Mahashweta Devi 'Draupadi', tr. Gayatri Chakravorty Spivak (Calcutta: Seagull, 2002)
4. Mary Wollstonecraft *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap. 1, pp. 11-19; chap. 2, pp. 19-38.  
Pandita Ramabai 'A Testimony of our Inexhaustible Treasures', in *Pandita Ramabai Through Her Own Words: Selected Works*, tr. Meera Kosambi (New Delhi: OUP, 2000) pp. 295-324.  
Rassundari Debi Excerpts from *Amar Jiban* in Susie Tharu and K. Lalita, eds., *Women's Writing in India*, vol. 1 (New Delhi: OUP, 1989) pp. 192-202

Suggested Topics and Background Prose Readings for Class Presentations

Topics

The Confessional Mode in Women's Writing

Sexual Politics

Race, Caste and Gender

Social Reform and Women's Rights

Readings

1. Virginia Woolf, *A Room of One's Own* (New York: Harcourt, 1957) chaps. 1 and 6.
2. Simone de Beauvoir, 'Introduction', in *The Second Sex*, tr. Constance Borde and Sheila Malovany-Chevallier (London: Vintage, 2010) pp. 3-18.
3. Kumkum Sangari and Sudesh Vaid, eds., 'Introduction', in *Recasting Women: Essays in Colonial History* (New Delhi: Kali for Women, 1989) pp. 1-25.
4. Chandra Talapade Mohanty, 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: A Reader*, ed. Padmini Mongia (New York: Arnold, 1996) pp. 172-97.

**Paper 5: Contemporary India: Women and Empowerment**

1. Social Construction of Gender (Masculinity and Femininity)  
Patriarchy
2. History of Women's Movements in India (Pre-independence, post independence)  
Women, Nationalism, Partition  
Women and Political Participation
3. Women and Law  
Women and the Indian Constitution

30

31

Personal Laws(Customary practices on inheritance and Marriage)  
(Supplemented by workshop on legal awareness)

4. Women and Environment  
State interventions, Domestic violence, Female foeticide, sexual harassment  
Female Voices: *Sultana's Dream*. Rokeya Sakhawat Hossain, "Sultana's Dream" *Sultana's Dream and Padmarag: Two Feminist Utopias*, New Delhi: Penguin, 2005. (1-15)

Dalit Discourse: "Baby Kondiba Kamble: *Jinne Amuche*" pg. 194-225 and "Vimal Dadasaheb More: *Teen Dagdachi Chul*" pg. 344-386 in *Writing Caste/ Writing Gender: Narrating Dalit Women's Testimonios*, ed. Sharmila Rege, New Delhi: Zubaan Books, 2006.

**Suggested Readings:**

**Social Construction of Gender**

- Ann Oakley. *Sex, Gender and Society*. London: Temple Smith, 1972.  
Kamala Bhasin. *What is Patriarchy?* New Delhi: Kali for Women, 1993.  
Kamala Bhasin. *Exploring Masculinity*, New Delhi: Women Unlimited, 2004.  
V. Geetha. *Gender*. Calcutta: Stree, 2002.  
Kate Millet. *Sexual Politics*. New York: Doubleday, 1970.

सेमेस्टर-3

( 3.3 )

HCC-7 : हिंदी कहानी

इकाई-1

- |                |   |                      |
|----------------|---|----------------------|
| 1. उसने कहा था | - | चंद्रधर शर्मा गुलेरी |
| 2. पूस की रात  | - | प्रेमचंद             |
| 3. छोटा जदून   | - | अस्ताद               |

इकाई-2

- |                 |   |                   |
|-----------------|---|-------------------|
| 4. पावथ         | - | वैवेन्द्र कुमार   |
| 5. तीसरी कसम    | - | कण्ठि जयवन्ध रेणु |
| 6. भीष्म की शपथ | - | भीष्म साहनी       |

इकाई-3

- |                   |   |              |
|-------------------|---|--------------|
| 7. परिन्दे        | - | निर्मल वर्मा |
| 8. चंपहर का भोजन  | - | अमरकान्त     |
| 9. सिक्का बदल गया | - | शूरणा सेवती  |

इकाई-4

- |                |   |                     |
|----------------|---|---------------------|
| 10. जंगल जलकम् | - | का तिनथ सिंह        |
| 11. धामसी      | - | उषा प्रियदर्शन      |
| 12. पुसपैठिणे  | - | अमरकान्त । जाल्मीकि |

सहायक ग्रंथ

- संकलित निबंध - नलिन किलोपन शर्मा
- 'एक दुनिया समाप्त' - राजेन्द्र पादव
- 'कहानी : नई कहानी' जगन्नाथ सिंह
- नई कहानी की भूमिका - कमलेश्वर
- हिंदी कहानी का इतिहास - नरेन्द्र राय

उत्तर

(ख) अस्मितामूलक विमर्श और हिंदी साहित्य

**इकाई-1 : विमर्शों की सैद्धांतिकी**

- (क) दलित विमर्श : अक्षरणा और आंदोलन, फूले और अम्बेडकर
- (ख) स्त्री विमर्श : अक्षरणाएँ और मुक्ति आंदोलन (पश्चात्त्व और भारतीय) ईडकल, मॉडर्निवादी, उदारवादी आदि, यौनिकता, लिंगभेद, चिंतुसता, सम्मर्भगकल
- (ग) अदिवसी विमर्श : अक्षरणा और आंदोलन जल, जंगल, जमीन और पहचान का सवाल

**इकाई-2 : विमर्शमूलक कथा साहित्य :**

- 1. ओम्डकाश जाल्नीक - सलाम,
- 2. हररगम नीण - धृणी तपे तीर, पुष्ठ संख्य 158-167
- 3. नसिरा शर्म - खुद की वापसी

**इकाई-3 : विमर्शमूलक कविता :**

- (क) दलित कविता : अलुतनर (दलित कहीं तक पहुँचेंगे), नगीम सिंह (कितनी ख्यादा) माता प्रसाद (सोना का पिंजरा)
- (ख) स्त्री कविता : 1. कीर्ति चौधरी : सोना रेखा 2. काल्याणी : सात भाइयों का बीच चम्पू 3. सविता सिंह : 'मैं किसकी औरत हूँ?'

**इकाई-4 : विमर्शमूलक अन्य गद्य किताएँ :**

- 1. प्रभा खेतान, पुष्ठ 28-42 : अन्या से अन्या तक
- 2. तुलसीराम मुर्दहिया (चौधरी चचा से प्रारंभ; पुष्ठ संख्या 125 से 135)
- 3. महारदेवी चर्मा : 'स्त्री का अर्थ स्वातंत्र्य का प्रश्न'

**सहायक ग्रंथ :**

- सिमोन र बोडवा - स्त्री उपेक्षिता

सेमेस्टर-5

( 5.2 )

HCC-12 : हिन्दी नाटक/एकांकी

इकाई-1	:	भारत दुर्गरा - भारतेन्दु
इकाई-2	:	धुक्स्वामिनी - जयशंकर प्रसाद
इकाई-3	:	बकरी - सर्वेश्वर दयाल मजूमदार
इकाई-4	:	दीपदान - रामकुमार वर्मा
		स्टाइक - भूवनेश्वर
		सूखी हाती - उपेन्द्रनाथ अशक
		तीन अनादित - विभिन्न कुमार अग्रवाल

सहायक ग्रंथ

- नाटककार भारतेन्दु की रंग-परिकल्पना - सत्येन्द्र तनेजा
- आधुनिक हिन्दी नाटक और रगमंच - सच्च, वैभवंद जैन
- हिन्दी एकांकी की शिल्पविधि का विकास - सिद्धनाथ कुमार
- हिन्दी नाटक : उद्भव और विकास - दशरथ अज्ञा
- हिन्दी के प्रतीक नाटक - रमेश गौतम
- हिन्दी नाटकों में विद्रोह की परम्परा - किरणचंद भार्गव
- जयशंकर प्रसाद : एक पुनर्मूल्यांकन - विवेक शाही
- प्रसाद के नाटक : स्वरूप और संरचना - गोविंद चातक
- हिन्दी नाटक का आत्मसंशोधन - गिरिश रस्तोगी
- नई रंगभेदना और हिन्दी नाटककार - जयदेव तनेजा
- नई रंगभेदना और बकरी - कुसुम लता
- एकांकी और एकांकीकार - रामचरण महेंद्र

**PROPOSED UNDER GRADUATE COURSES FOR SANSKRIT (HON.)  
UNDER CHOICE BASED CREDIT SYSTEM (CBCS)**

**Detail of the Core Course for Sanskrit**

C-7 Indian Social Institutions and Polity		
<b>[A] Prescribed Course:</b>		<b>Total 56 Credits</b>
Section 'A'	Indian Social Institutions : Nature and Concepts	12 Credits
Section 'B'	Structure of Society and Value of Life	14 Credits
Section 'C'	Indian Polity : Origin and Development	18 Credits
Section 'D'	Cardinal Theories and Thinkers of Indian Polity	12 Credits
<b>[B] Course Objectives:</b>	Social institutions and Indian Polity have been highlighted in <i>Dharma-sāstra</i> literature. The aim of this course is to make the students acquainted with various aspects of social institutions and Indian polity as propounded in the ancient Sanskrit texts such as <i>Saṁhitās, Mahābhārata, Purāṇa, Kauṭilya's Arthasāstra</i> and other works known as <i>Nītiśāstra</i> .	
<b>[C] Unit-Wise Division:</b>	<b>Section 'A'</b> <b>Indian Social Institutions : Nature and Concepts</b>	
	<b>Indian Social Institutions : Definition and Scope:</b> Sociological Definition of Social Institutions. Trends of Social Changes, Sources of Indian Social Institutions (Vedic Literature, <i>Sūtra</i> Literature, <i>Purāṇas, Rāmāyana, Mahābhārata, Dharmasāstras</i> , Buddhist and Jain Literature, Literary Works, Inscriptions, Memoirs of Foreign Writers)	<b>06 Credits</b>
Unit: I		
	<b>Social Institutions and <i>Dharmasāstra</i> Literature:</b> <i>Dharmasāstra</i> as a special branch of studies of Social Institutions, sources of <i>Dharma</i> ( <i>Manusmṛti</i> , 2.12; <i>Yājñavalkyasmṛti</i> , 1.7). Different kinds of <i>Dharma</i> in the sense of Social Ethics ( <i>Manusmṛti</i> , 10.63; <i>Viṣṇusūtra</i> 2.16-17); Six kinds of <i>Dharma</i> in the sense of Duties ( <i>Mitākṣarāṅikā</i> on <i>Yājñavalkyasmṛti</i> , 1.1). Tenfold <i>Dharma</i> as Ethical Qualities ( <i>Manusmṛti</i> , 6.92); Fourteen- <i>Dharmasthānas</i> ( <i>Yājñavalkyasmṛti</i> , 1.3)	<b>06 Credits</b>
Unit: II		



PROPOSED UNDER GRADUATE COURSES FOR SANSKRIT (HON.) UNDER CHOICE BASED CREDIT SYSTEM (CBCS)		
Generic Elective (GE) Course for Sanskrit		
GE-2 Indian Culture and Social Issues		
[A]	<b>Prescribed Course:</b>	<b>Total 56 Credits</b>
	Section 'A' Culture in a multi-cultural society	26 Credits
	Section 'B' Cultural roots of India	30 Credits
[B]	<b>Course Objectives:</b>	
	This paper is designed to introduce nuances of Indian culture to students and to show how cultural traditions have evolved. The paper also engages them in debates about certain significant socio-cultural issues.	
[C]	<b>Unit-Wise Division:</b>	
	<b>Section 'A'</b>	
	<b>Understanding Culture</b>	
Unit: I	1. What is culture? Culture and Civilization 2. What is 'Indian' culture? 3. Culture in a multi-cultural society	<b>06 Credits</b>
Unit: II	1. Vedic sabhyata 2. Sindhu sabhyata 3. Sanskrit in Indo-Islamic tradition – (Proceedings of the Sagar University seminar on 'Islām kā Sanskrit paramparā ko yogadāna')	<b>09 Credits</b>
Unit: III	1. Pandavānī, 2. Versions of the Rāma legend in Sanskrit literature – Vālmīki's Rāmāyaṇa, Bhāsa's Pratimā nāṭakam, Bhavabhūti's Uttarāma caritam, Raghuvamśam of Kalidasa, Somadeva's Kathāsaritsāgara, Rāmāyaṇa mañjarī of Rājasekhara etc. 3. Ritusamhāra in folk music 4. Sanskrit themes in traditional dance forms in Kerala 5. Yakṣagan 6. Gītagovinda and Odissi 7. Major agricultural and seasonal festivals of India and the Indian calendar – Bihu, Holi, Pongal, Makar Sankranti, Lohari, Onam, Baisakhi, Śrāvāṇī Pūrṇimā	<b>12 Credits</b>

PROPOSED UNDER GRADUATE COURSES FOR SANSKRIT (HON.) UNDER CHOICE BASED CREDIT SYSTEM (CBCS)		
Generic Elective (GE) Course for Sanskrit		
GE-4 Basic Principles of Indian Medicine System (Ayurveda)		
[A]	<b>Prescribed Course:</b>	<b>Total 56 Credits</b>
	Section 'A' Introduction to Indian Medicine System: Āyurveda	12 Credits
	Section 'B' Basic Principles of Āyurveda	18 Credits
	Section 'C' Dietetics, Nutrition and Treatments in Āyurveda	18 Credits
	Section 'D' Important Medicinal Plants and their based on Āyurveda	08 Credits
[B]	<b>Course Objectives:</b>	
	Āyurveda is a traditional Indian system of healthcare that has been traced back to as early as 5,000 BCE. This course will introduce students to the theory of Āyurveda. The major objective is to understand the basic principles and concepts of preventive medicine and health care, diet and nutrition, usage of commonly used spices and herbs and an outline of Āyurvedic therapeutic procedures in Āyurveda.	
[C]	<b>Unit-Wise Division</b>	
	<b>Section 'A'</b>	
	<b>Introduction to Indian Medicine System: Āyurveda</b>	
	Definition of Āyurveda, Āyuh (Life), Śarīra (Body), Health, Aim of Āyurveda, Subject Matter of Āyurveda, Salient Features of Āyurveda, Concept of Health according to Āyurveda, Unique features of Āyurveda.	
	Unit: I	04 Credits
	History of Āyurveda, Atharvaveda as an early source for medicinal speculations, Introduction to Major Texts (Suśruta Saṁhitā and Caraka Saṁhitā) and Authors (Suśruta and Caraka) and Aṣṭāṅga Hṛdayam, Aṣṭāṅga Saṅgraha of Vāgbhaṭa.	
	Unit: II	04 Credits
	Eight Components of Āyurveda (aṣṭāṅga-Āyurveda):	
	1. Kāyçikitsā (General Medicine)	
	2. Kaumārabhṛtya (Pediatrics)	
	3. Śalya Tantra (Surgery)	
	4. Śālākya-Tantra (Ent. and Ophthalmology)	
	Unit: III	04 Credits
	5. Bhūta Vidyā (Psychiatry Medicine).	
	6. Viṣa Vijñāna (Toxicology).	
	7. Rasāyana (Rejuvenates).	
	8. Vajīkaraṇa (Aphrodisiac).	
	<b>Section 'B'</b>	

**PROPOSED UNDER GRADUATE COURSES FOR SANSKRIT (HON.)  
UNDER CHOICE BASED CREDIT SYSTEM (CBCS)**

**Generic Elective (GE) Course for Sanskrit**

**GE-10**

**Individual, Family and Community in Indian Social  
Thought**

<b>[A] Prescribed Course:</b>	<b>Total 56 Credits</b>
Section 'A'      Individual	20 Credits
Section 'B'      Family	15 Credits
Section 'C'      Community	15 Credits

**[B] Course Objectives:**

This course will introduce the current research and development in Sanskrit computing. Primary emphasis will be on tools and techniques developed under government and private funding and to explore new technologies for Sanskrit.

**[C] Unit-Wise Division:**

**Section 'A'  
Individual**

<b>Unit: I</b>	Idea of a person (Gītā 6/5) ; Functions of the indriyas, buddhi, manas and the ātmā – (Gītā 3/42, 15/7, 15/9, 3/34, 2/58, 2/59, 3/6-7, 5/8, 2/ 64)	<b>05 Credits</b>
<b>Unit: II</b>	Three guṇas and their impact on the individual (Gītā 14/5-13, 14/17, 3/36-38, 18/30-32, Managing the mind-body mechanism according to the Gītā – (i) yoga of action, (2/47-48, 3/8, 3/ 4, 3/19, 3/25) (ii) yoga of bhakti – 7/1, 8/7, 9/14, 9/27, 12/11, 12/ 13-19) (iii) (yoga of knowledge, (4/38-39, 4/42, 18/63) (iv) yoga of meditation (16/34, 16/12, 16/26, 16/25 )	<b>05 Credits</b>
<b>Unit: III</b>	Saṁskāras – Growth of the individual in society (From : Importance of saṁskāras in Hīndu Saṁskāra – Rajabali Pandey)	<b>05 Credits</b>
<b>Unit: IV</b>	Aim of life : Four Puruṣārtha	<b>05 Credits</b>

**2. Human Rights in a Comparative Perspective**

**Course objective:** This course attempts to build an understanding of human rights among students through a study of specific issues in a comparative perspective. It is important for students to see how debates on human rights have taken distinct forms historically and in the contemporary world. The course seeks to anchor all issues in the Indian context, and pulls out another country to form a broader comparative frame. Students will be expected to use a range of resources, including films, biographies, and official documents to study each theme. Thematic discussion of sub-topics in the second and third sections should include state response to issues and structural violence questions.

**I. Human Rights: Theory and Institutionalization (3 weeks)**

- a. Understanding Human Rights: Three Generations of Rights
- b. Institutionalization: Universal Declaration of Human Rights
- c. Rights in National Constitutions: South Africa and India

**II. Issues (5 weeks)**

- a. Torture: USA and India
- b. Surveillance and Censorship: China and India
- c. Terrorism and Insecurity of Minorities: USA and India

**III. Structural Violence (4 weeks)**

- a. Caste and Race: South Africa and India
- b. Gender and Violence: India and Pakistan
- c. Adivasis/Aboriginals and the Land Question: Australia and India

**READING LIST**

**I. Human Rights: Theory and Institutionalization**

Essential Readings:

J. Hoffman and P. Graham, (2006) 'Human Rights', *Introduction to Political Theory*, Delhi, Pearson, pp. 436-458.

SAHRDC (2006) 'Introduction to Human Rights'; 'Classification of Human Rights: An Overview of the First, Second, and Third Generational Rights', in *Introducing Human Rights*, New Delhi: Oxford University Press.

The Constitution of the Republic of South Africa, Chapter 2: Bill of Rights.

The Constitution of India, Chapter 3: Fundamental Rights

**II. Issues**

**a. Torture: USA and India**

Essential Readings:

DEPARTMENT OF ENVIRONMENTAL STUDIES  
UNIVERSITY OF DELHIEnvironmental Studies\*  
(Six-month Module for Undergraduate Courses)**Unit 1 : Introduction to environmental studies**

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

**Unit 2 : Ecosystems**

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- Ecological succession.
- Case studies of the following ecosystems :
  - a) Forest ecosystem
  - b) Grassland ecosystem
  - c) Desert ecosystem
  - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

**Unit 3 : Natural Resources : Renewable and Non-renewable Resources**

- Land resources and land use change : Land as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

(8 lectures)

**Unit 4 : Biodiversity and Conservation**

- Levels of biological diversity : genetic, species and ecosystem diversity.
- Biogeographic zones of India
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions.
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

(8 lectures)

**Unit 5 : Environmental Pollution**

- What is environmental pollution and its types?
- Causes, effects and control measures of :
  - a) Air pollution

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- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

**Unit 6 : Environmental Policies & Practices**

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

**Unit 7 : Human Population and the Environment**

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

**Unit 8 : Field work**

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

**Suggested Further Readings:**

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Environment and Security. Stockholm Environmental Institute, Oxford University Press.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation biology.

**(xii) ENVIRONMENTAL ECONOMICS****Course Description**

This course focuses on economic causes of environmental problems. In particular, economic principles are applied to environmental questions and their management through various economic institutions, economic incentives and other instruments and policies. Economic implications of environmental policy are also addressed as well as valuation of environmental quality, quantification of environmental damages, tools for evaluation of environmental projects such as cost-benefit analysis and environmental impact assessments. Selected topics on international environmental problems are also discussed.

**Course Outline****1. Introduction**

What is environmental economics; review of microeconomics and welfare economics.

**2. The Theory of Externalities**

Pareto optimality and market failure in the presence of externalities; property rights and the Coase theorem.

**3. The Design and Implementation of Environmental Policy**

Overview; Pigouvian taxes and effluent fees; tradable permits; choice between taxes and quotas under uncertainty; implementation of environmental policy.

**4. International Environmental Problems**

Trans-boundary environmental problems; economics of climate change; trade and environment.

**5. Measuring the Benefits of Environmental Improvements**

Non-Market values and measurement methods; risk assessment and perception.

**6. Sustainable Development**

Concepts; measurement.

**Readings:**

1. Charles Kolstad, *Intermediate Environmental Economics*, Oxford University Press, 2<sup>nd</sup> edition, 2010.
2. Robert N. Stavins (ed.), *Economics of the Environment: Selected Readings*, W.W. Norton, 5<sup>th</sup> edition, 2005.
3. Roger Perman, Yue Ma, James McGilvray and Michael Common, *Natural Resource and Environmental Economics*, Pearson Education/Addison Wesley, 3<sup>rd</sup> edition, 2003.
4. Maureen L. Cropper and Wallace E. Oates, 1992, -Environmental Economics: A Survey, *Journal of Economic Literature*, Volume 30:675-740.

**Care Course IX: Ecology**  
(Credit: Theory-4, Practical-2)  
**THEORY**  
**Lectures: 60**

<b>Unit 1: Introduction</b>	<b>(4 lectures)</b>
Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.	
<b>Unit 2: Soil</b>	<b>(8 lectures)</b>
Importance; Origin; Formation; Composition; Physical, Chemical and Biological components; Soil profile; Role of climate in soil development.	
<b>Unit 3: Water</b>	<b>(4 lectures)</b>
Importance; States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.	
<b>Unit 4: Light, temperature, wind and fire</b>	<b>(6 lectures)</b>
Variations; adaptations of plants to their variation.	
<b>Unit 5: Biotic interactions</b>	<b>(2 lectures)</b>
<b>Unit 6: Population ecology</b>	<b>(4 lectures)</b>
Characteristics and Dynamics. Ecological Speciation	
<b>Unit 7: Plant communities</b>	<b>(8 lectures)</b>
Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types, climax concepts.	
<b>Unit 8: Ecosystems</b>	<b>(4 lectures)</b>
Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.	
<b>Unit 9: Functional aspects of ecosystem</b>	<b>(8 lectures)</b>
Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	
<b>Unit 10: Phytogeography</b>	<b>(12 lectures)</b>
Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.	

**Practical**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovi bond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
7. (a). Study of morphological adaptations of hydrophytes and xerophytes (five each).
- (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobancha*) Epiphytes, Predation (Insect/vermin plants).
8. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
9. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
10. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
11. Field visit to familiarise students with ecology of different sites.

**Suggested Readings**

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5<sup>th</sup> edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

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**Care Course IX: Ecology**  
(Credit: Theory-4, Practical-2)  
**THEORY**  
Lectures: 60

<b>Unit 1: Introduction</b>	(4 lectures)
Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamics, homeostasis.	
<b>Unit 2: Soil</b>	(8 lectures)
Importance; Origin; Formation; Composition; Physical, Chemical and Biological components; Soil profile; Role of climate in soil development.	
<b>Unit 3: Water</b>	(4 lectures)
Importance; States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.	
<b>Unit 4: Light, temperature, wind and fire</b>	(6 lectures)
Variations; adaptations of plants to their variation.	
<b>Unit 5: Biotic interactions</b>	(2 lectures)
<b>Unit 6: Population ecology</b>	(4 lectures)
Characteristics and Dynamics, Ecological Speciation	
<b>Unit 7: Plant communities</b>	(8 lectures)
Concepts of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types, climax concepts.	
<b>Unit 8: Ecosystems</b>	(4 lectures)
Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.	
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Principles; Continental drift, Theory of tolerance, Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.	

**Practical**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Levi bond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
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7. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each).
- (b). Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orsbanckia) Epiphytes, Predation (Insectivorous plants).
8. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
9. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
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11. Field visit to familiarise students with ecology of different sites.

**Suggested Readings**

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5<sup>th</sup> edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2005). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8<sup>th</sup> edition.
4. Wilkenen, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kotrsandy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4<sup>th</sup> edition.

**Keywords:**

Green chemistry, Twelve principles of green chemistry, Atom economy, Waste minimization, Green metric, Green solvents, Solvent free, Catalyst, Bio-catalyst, Renewable energy sources, Hazardous, Renewable feedstock, Ionic liquids, Supercritical fluids, Inherent safer design, Green synthesis, Co-crystal controlled solid state synthesis, Sustainable development, Presidential green chemistry awards.

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**Course Code: CHEMISTRY –DSE-9****Course Title: Industrial Chemicals and Environment****Total Credits: 06****(Credits: Theory-04, Practical-02)****(Total Lectures: Theory- 60, Practical-60)**

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**Objectives:**

The objective of this course is to make students aware about the concepts of different gases and their industrial production, uses, storage and hazards. Manufacturing, applications, analysis and hazards of the Inorganic Chemicals, Preparation of Ultra-Pure metals for semiconducting technology, Air and Water pollution, control measures for Air and Water Pollutants, Catalyst and Biocatalyst, Energy and Environment.

**Learning Outcomes:**

By the end of this course students will be able to understand:

- The different toxic gases and their toxicity hazards
- Safe design systems for large scale production of industrial gases.
- Manufacturing processes, handling and storage of inorganic chemicals.
- Hazardous effects of the inorganic chemicals on human beings and vegetation.
- The requirement of ultra-pure metals for the semiconducting technologies
- Composition of air, various air pollutants, effects and control measures of air pollutants.
- Different sources of water, water quality parameters, impacts of water pollution, water treatment.
- Different industrial effluents and their treatment methods.
- Different sources of energy.
- Generation of nuclear waste and its disposal.
- Use of biocatalyst in chemical industries.

**Unit 1:**

**Industrial Gases:** Large scale production, uses storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, and sulphur dioxide.

**(Lectures: 6)****Unit 2:**

**Inorganic Chemicals:** Manufacture, applications, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potassium dichromate and potassium permanganate

(Lectures: 10)

### Unit 3:

**Industrial Metallurgy:** Preparation of ultrapure metals for semiconductor technology.

(Lectures: 4)

### Unit 4:

**Environment and its segments:**

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere, chemical and photochemical reactions in atmosphere.

Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Major sources of air pollution, Pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases, methods of estimation of CO, NO<sub>x</sub>, SO<sub>2</sub> and control procedures, Effects of air pollution on living organisms and vegetation

Greenhouse effect and Global warming, Environmental effects of ozone, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and halogens, Air pollution control, Settling Chambers, Venturi Scrubbers, Cyclones, Electrostatic Precipitators (ESPs).

(Lectures:15)

### Unit 5:

**Water Pollution:**

Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological cycle and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro fertilizer.

Sludge disposal. Industrial waste management, incineration of waste.

Water treatment and purification (reverse osmosis, electro dialysis, ion exchange).

Water quality parameters for wastewater, industrial water and domestic water.

(Lectures:15)

### Unit 6:

**Energy & Environment:** Sources of energy: Coal, petrol and natural gas. Nuclear fusion / fission, solar, hydrogen, geothermal, tidal and hydel.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis: Introduction to biocatalysis: Importance in green chemistry and chemical industry.

(Lectures: 10)

### Practical:

(Credits: 2, Laboratory periods: 60)

#### Chemistry Lab: Industrial Chemicals & Environment

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD).
3. Determination of Biological Oxygen Demand (BOD).
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO<sub>3</sub> and potassium chromate).
6. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
7. Measurement of dissolved CO<sub>2</sub>.
8. Determination of hexavalent Chromium Cr(VI) concentration in tannery wastes/waste water sample using UV-Vis spectrophotometry technique.
9. Preparation of borax/ boric acid

### References:

#### Theory

1. Manahan, S.E. (2017), **Environmental Chemistry**, CRC Press
2. Buchel, K.H.; Moretto, H.H.; Woditsch, P. (2003), **Industrial Inorganic Chemistry**, Wiley-VCH.
3. De, A.K. (2012), **Environmental Chemistry**, New Age International Pvt., Ltd.
4. Khopkar, S.M. (2010), **Environmental Pollution Analysis**, New Age International Publisher.

#### Practical

1. Vowles, P.D.; Connell, D.W. (1990), **Experiments in Environmental Chemistry: A Laboratory Manual**, Vol.4, Pergamon Series in Environmental Science.
2. Gopalan, R.; Anand, A.; Sugumar R.W. (2008), **A Laboratory Manual for Environmental Chemistry**, I. K. International.

## **1. Disaster Management**

1. Disasters: Definition and Concepts: Hazards, Disasters; Risk and Vulnerability; Classification
2. Disasters in India: (a) Flood: Causes, Impact, Distribution and Mapping; Landslide: Causes, Impact, Distribution and Mapping; Drought: Causes, Impact, Distribution and Mapping
3. Disasters in India: (b) Earthquake and Tsunami: Causes, Impact, Distribution and Mapping; Cyclone: Causes, Impact, Distribution and Mapping.
4. Manmade disasters: Causes, Impact, Distribution and Mapping
5. Response and Mitigation to Disasters: Mitigation and Preparedness, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts During and Post Disasters

### **Reading List**

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Opportunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India ([www.ikbooks.com](http://www.ikbooks.com)).

**9. Environmental Geography**

1. Environmental Geography – Concept and Scope
2. Human-Environment Relationships – Historical Progression, Adaptation in different Biomes.
3. Ecosystem – Concept, Structure and Functions
4. Environmental Problems in Tropical, Temperate and Polar Ecosystems
5. Environmental Programmes and Policies – Global, National and Local levels

**Reading List**

1. Chandna R. C., 2002: *Environmental Geography*, Kalyani, Ludhiana.
2. Cunningham W. P. and Cunningham M. A., 2004: *Principals of Environmental Science: Inquiry and Applications*, Tata Macgraw Hill, New Delhi.
3. Goudie A., 2001: *The Nature of the Environment*, Blackwell, Oxford.
4. Mal, Suraj., and Singh, R.B. (Eds.) (2009) *Biogeography and Biodiversity*. Rawat Publication, Jaipur
5. Miller G. T., 2004: *Environmental Science: Working with the Earth*, Thomson BrooksCole, Singapore.
6. MoEF, 2006: *National Environmental Policy-2006*, Ministry of Environment and Forests, Government of India.
7. Singh, R.B. and Hietala, R. (Eds.) (2014) *Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India*. *Advances in Geographical and Environmental Studies*, Springer
8. Odum, E. P. et al, 2005: *Fundamentals of Ecology*, Cengage Learning India.
9. Singh S., 1997: *Environmental Geography*, Prayag Pustak Bhawan, Allahabad.
10. UNEP, 2007: *Global Environment Outlook: GEO4: Environment For Development*, United Nations Environment Programme.
11. Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) (2014) *Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1*. *Advances in Geographical and Environmental Studies*, Springer
12. Singh, R.B. (1998) *Ecological Techniques and Approaches to Vulnerable Environment*, New Delhi, Oxford & IBH Pub..
13. Singh, Savindra 2001. *Paryavaran Bhugol*, Prayag Pustak Bhawan, Allahabad. (in Hindi)

**5. Climate Change: Vulnerability and Adaptation**

1. Science of Climate Change: Understanding Climate Change; Green House Gases and Global Warming; Global Climatic Assessment- IPCC
2. Climate Change and Vulnerability: Physical Vulnerability; Economic Vulnerability; Social Vulnerability
3. Impact of Climate Change: Agriculture and Water; Flora and Fauna; Human Health
4. Adaptation and Mitigation: Global Initiatives with Particular Reference to South Asia.
5. National Action Plan on Climate Change; Local Institutions (Urban Local Bodies, Panchayats)

**Further Readings**

1. IPCC. (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
2. IPCC (2014) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
3. IPCC (2014) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
4. Palutikof, J. P., van der Linden, P. J. and Hanson, C. E. (eds.), Cambridge University Press, Cambridge, UK.
5. OECD. (2008) Climate Change Mitigation: What Do we Do? Organisation and Economic Co-operation and Development.
6. UNEP. (2007) Global Environment Outlook: GEO4: Environment for Development, United Nations Environment Programme.
7. Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) (2014) Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1. Advances in Geographical and Environmental Studies, Springer
8. Sen Roy, S. and Singh, R.B. (2002) Climate Variability, Extreme Events and Agricultural Productivity in Mountain Regions, Oxford & IBH Pub., New Delhi.

**14. Disaster Management based Project Work (Practical)**

The Project Report based on any two field based case studies among following disasters and one disaster preparedness plan of respective college or locality:

1. Flood
2. Drought
3. Cyclone and Hailstorms
4. Earthquake
5. Landslides
6. Human Induced Disasters: Fire Hazards, Chemical, Industrial accidents

**Reading List**

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Opportunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India ([www.ikbooks.com](http://www.ikbooks.com)).



## **8. Sustainable Resource Development**

### **Course Objective:**

1. To learn the concepts related with Sustainable development and its role in reducing poverty and inequality in the world.
2. To get updated knowledge of Millennium Development Goals & Sustainable Development Goals.
3. To critically evaluate the global policies and programmes for sustainable development.

### **Learning Outcome:**

After Studying, Students will be able to

1. Understand the basic concept of sustainable resource development and differentiate between the Millennium development goals and Sustainable development goals.
2. Assess the issues associated with the Inclusive Development.
3. Explain the sustainable development policies and programmes

### **Course Content:**

1. Sustainable Development and Sustainability: Definition, Components and Limitations
2. The Millennium Development Goals: Experiences, India's Effort, Performance and Strategies.
3. Sustainable Resource Development: Water Sustainability in Arid Regions, Forest Sustainability in Mountain Regions, Marine Resource Sustainability, Resources and Sustainable Cities.
4. Inclusive Development: Poverty and Inequality; Education (The role of higher education in sustainable resource development), Health: The Challenges of Universal Health Coverage; Climate Change: Policies and Global Cooperation for Climate Change
5. Sustainable Development Policies and Programmes: The proposal for SDGs at Rio+20; Illustrative SDGs; Goal-Based Development; Financing for Sustainable Development; Principles of Good Governance; CDM.

### **References:**

#### **Essential:**

1. Agyeman, J., Robert D. B., and Bob, E. (Eds.) (2003). *Just Sustainabilities: Development in an Unequal World*. London, UK: Earthscan. (Introduction and conclusion.).
2. Ayers, Jessica and David, Dodman. (2010). *Climate change adaptation and development I: the state of the debate*. USA: Sage, Progress in Development Studies 10(2): 161-168.

3. Baker, Susan. (2006). *Sustainable Development*. New York, N.Y.: Routledge.
4. Brosius, P. (1997). *Endangered forest, endangered people: Environmentalist representations of indigenous knowledge*. *Human Ecology* 25: 47-69.
5. Singh, R.B. (Ed.) (2001): *Urban Sustainability in the Context of Global Change*. Science Pub., Inc., New Delhi, India: Enfield (NH), USA and Oxford & IBH Pub.

**Suggestive:**

1. Lohman, Larry. (2003). *Re-imagining the population debate*. UK: Comer House Briefing.
2. Martínez-Alier, Joan. (2010). *Sustainable de-growth: Mapping the context, criticisms and future prospects of an emergent paradigm*. *Ecological Economics* 69: 1741-1747.
3. Merchant, Carolyn. (Ed.). (1994): *Ecology. Atlantic Highlands, N.J., USA: Humanities Press*. (Introduction, pp 1-25.)
4. Osorio, Leonardo., et al. (2005). *Debates on sustainable development: towards a holistic view of reality*. Switzerland: *Environment, Development and Sustainability* 7: 501-518.
5. Robbins, Paul. (2004). *Political Ecology: A Critical Introduction*. UK: Blackwell Publishing.

**Teaching Learning Plan**

Week 1: Unit I

Week 2: Unit I

Week 3: Unit II

Week 4: Unit II

Week 5: Unit III

**Week 6: Mid-Semester Examinations**

**Week 7: Mid-Semester Break**

Week 8: Unit III

Week 9: Unit IV

Week 10: Unit IV

Week 11: Unit V

Week 12: Unit V

### Assessment Methods:

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1	Sustainable Resource Development: Definition, Components and Limitations	Classroom Lectures, Tutorials, PPT	Assignments, Discussions/Debates classroom test.
2	The Millennium Development Goals: National Strategies and International Experiences	Classroom Lectures, Tutorials, PPT	Assignments, Discussions/ Debates, classroom test.
3	Sustainable Regional Development: Need and examples from different Ecosystems.	Classroom Lectures, Tutorials, PPT	Assignments, Discussion/Debates, classroom test.
4	Inclusive Development: Poverty and Inequality; Education, Health; Climate Change: The role of higher education in sustainable resource development; The Challenges of Universal Health Coverage,	Classroom Lectures, Tutorials, PPT	Assignments, Discussions/Debates, classroom test.
5	Inclusive Development: Poverty and Inequality; Education, Health; Climate Change: The role of higher education in sustainable resource development; The Challenges of Universal Health Coverage,	Classroom Lectures, Tutorials, PPT	Assignments, Discussions/Debates classroom test.

**Keywords:** Sustainable, Resource, Development, MDGs, SDGs, Inclusive, Policies, Programmes

Attested by the Principal,  
Shivaji College (University of Delhi)

*Shivaji*

अभ्यवहक प्राध्यापक / Officiating Principal  
शिवजी महाविद्यालय / Shivaji College  
(दिल्ली विश्वविद्यालय) / (University of Delhi)  
राजा गार्डन, नई दिल्ली-110027  
Raja Garden, New Delhi-110027

## **4. Environmental Geography**

### **Course Objectives:**

- 1) This course shall introduce the basic concepts and approaches of environmental geography.
- 2) This paper shall elucidate about human-environmental relationship, environmental programs and their management.
- 3) This course shall provide detailed understanding related to environmental programmes and policies with specific reference to New Environmental Policy of India.

### **Learning Outcomes:**

- 1) This paper shall enable the students to understand basic concepts and approaches related to environmental geography.
- 2) This course shall enable the students to comprehend about human-environment relationship, and different environmental problems and its management.
- 3) Students shall be well-versed with the analysing the environmental programmes and policies.

### **Course Contents:**

1. Environmental Geography: Concepts and Approaches; Ecosystem – Concept and Structure; Ecosystem Functions.
2. Human-Environment Relationship in Equatorial, Desert, Mountain and Coastal Regions.
3. Environmental Problems and Management: Air Pollution; Biodiversity Loss; Solid and Liquid Waste.
4. Environmental Programmes and Policies: Developed Countries; Developing Countries.
5. New Environmental Policy of India; Government Initiatives.

### **References:**

#### **Essential:**

1. Casper J.K. (2010). *Changing Ecosystems: Effects of Global Warming*. New York, USA: Infobase Pub.
2. Hudson, T. (2011). *Living with Earth: An Introduction to Environmental Geology*. Delhi, India: PHI Learning Private Limited.
3. Miller, G.T. (2007). *Living in the Environment: Principles, Connections, and Solutions*. Belmont, Australia: Brooks/ Cole Cengage Learning.
4. Singh, R.B. (1993) *Environmental Geography*. Delhi, India: Heritage Publishers.
5. UNEP. (2007). *Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme*. UK: University Press, Cambridge.

#### **Suggestive:**

1. Singh, R.B. and Hietala, R. (Eds.) (2014). *Livelihood security in Northwestern*

- Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies.* Tokyo, Japan: Springer
2. Singh, Savindra 2001. *Paryavaran Bhugol*. Allahabad, India: Prayag Pustak Bhawan.
  3. Wright R. T. and Boorse, D. F. (2010). *Toward a Sustainable Future*. Delhi, India: PHI Learning Pvt Ltd.

### **Teaching Learning Plan**

Week 1: Unit I

Week 2: Unit I

Week 3: Unit II

Week 4: Unit II

Week 5: Unit III

***Week 6: Mid-Semester Examinations***

***Week 7: Mid-Semester Break***

Week 8: Unit III

Week 9: Unit IV

Week 10: Unit IV

Week 11: Unit V

Week 12: Unit V

Attested by the Principal,  
**Shivaji College (University of Delhi)**

*Shivaji* *Satdew*

कार्यवाहक प्राचार्य / Officiating Principal  
शिवजी महाविद्यालय / Shivaji College  
(दिल्ली विश्वविद्यालय) / (University of Delhi)  
राजा गार्डन, नई दिल्ली-110027  
Raja Garden, New Delhi-110027

## 9. Environmental Geography

### Course Objectives:

1. Various dimensions of environment and natural resource management.
2. Detailed analysis of concept, structure and functions.
3. Understanding of the concept of appraisal and conservation of Environment and Natural Resources.

### Learning Outcome:

1. Detailed exposure of human – environment relationship.
2. In-depth knowledge of environmental issues in tropical, temperate and polar ecosystems.
3. Understanding the environmental programmes and policies at local as well as global level.

### Course Content:

1. Introduction to Natural Resource and Environment: Basic Concept; Human-Environment Relationships- Resource Use and abuse, Concept of resource curse
2. Ecosystem: Concept, Structure and Functions; Ecosystem services and ecological footprints.
3. Natural Resource: Concept (Zimmermann), Classification, Utilization, Problems and Management of Land, Water, forest and energy resources.
4. Environmental Issues in Tropical, Temperate and Polar Ecosystems. Global environmental issues: Impacts on land, soil, water, climate and atmosphere, biodiversity loss; and human health
5. Appraisal and Conservation of Environment and Natural Resources and Sustainable Resource Development, Environmental Programmes and Policies – Global, National and Local levels. Management of Environment and Resources: Principle of conservation, restoration and sustainable alternatives; Importance of EIA.

### References:

#### Essential:

1. Chandna, R. C. (2002). *Environmental Geography*. Ludhiana, India: Kalyani.
2. Cunningham, W. P. and Cunningham, M. A. (2004). *Principals of Environmental Science: Inquiry and Applications*. Delhi: Tata Macgraw Hill.
3. Odum, E. P. et al. (2005). *Fundamentals of Ecolog*. India: Ceneage Learning
4. Singh, R.B., and Hictala, R. (Eds.) (2014). *Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies*. USA: Springer

5. Singh, Savindra.,(2001). *Paryavaran Bhugol (Hindi)*,Allahabad, India: Prayag Pustak Bhawan.
6. Singh,R.B., Prokop, Pawel (Eds.) (2016). *Environmental Geography of South Asia*.Tokyo, Japan: Springer.

**Suggestive:**

- 1 Goudic, A. (2001). *The Nature of the Environment*, Oxford, UK: Blackwell.
- 2 Holechek, J. L. C., Richard, A., Fisher, J. T. and Valdez, R. (2003). *Natural Resources: Ecology, Economics and Policy*. New Jersey, USA: Prentice Hall.
- 3 Mitchell, B. (1997). *Resource and Environmental Management*. England: Longman Harlow.
- 4 Saxena, H.M. (2012). *Environmental Studies*. Jaipur, India: Rawat Publications.

**Teaching Learning Plan**

Week 1: Unit I

Week 2: Unit I

Week 3: Unit II

Week 4: Unit II

Week 5: Unit III

***Week 6: Mid-Semester Examinations***

***Week 7: Mid-Semester Break***

Week 8: Unit III

Week 9: Unit IV

Week 10: Unit IV

Week 11: Unit V

Week 12: Unit V

**10. Field Work and Research Methodology (Practical)**

**Course Objectives:**

1. Various dimensions of field work and its role in geographical studies..
2. Detailed analysis of different field techniques.
3. Understanding of the report writing and field tools.

**Learning Outcome:**

1. Detailed exposure of new geographical landscape as study area.
2. In-depth knowledge of different field techniques.
3. Understanding the field ethics and different tools of field study.

**Course Content:**

1. Field Work In Geographical Studies – Role, Value, Data and Ethics of Field-Work;  
Defining the Field and Identifying the Case Study – Rural / Urban / Physical /  
Human / Environmental.



## **4. Coupled Human and Environment System**

### **Course Objectives:**

1. Various dimensions of concepts, components and theories of coupled human environment system.
2. Detailed analysis of different biogeochemical cycles.
3. Understanding of the concept of lowland and highland interaction.

### **Learning Outcome:**

1. Detailed exposure of climate change and related issues.
2. In-depth knowledge of interactions and impact between human and natural systems.
3. Understanding the management and policies related to human and environment system.

### **Course Content:**

1. Concepts, components and theories of coupled human environment system.
2. Biogeochemical cycles: Interactions and impact between human and natural systems.
3. Global and regional case studies: Himalaya-Ganga system; Atmosphere-water system; Surface and ground water and Coastal-water interaction.
4. Integrated Assessment of Vulnerability Risk; Resilience and Sustainability.
5. Management, Governance and Policies.

### **References:**

### **Essential:**

1. Clarke, G. L. (1967). *Elements of ecology*. New York, USA: John Wiley Pub.
2. Haden-Guest, S., Wright, J. K., and Teclaff, E. M. (1956). *World Geography of Forest Resources*. New York, USA: Ronald Press Co.
3. Hoyt, J.B. (1992). *Man, and the Earth*. USA: Prentice Hall.
4. Lapedes, D.N. (1974). *Encyclopaedia of Environmental Science (eds.)*. USA: McGraw Hill.
5. Parmesan, C., Yohe, G. (2003). *A globally coherent fingerprint of climate change impacts across natural systems*. UK: Nature, 421 (6918), 37–42.
6. Singh, R.B., Schickhoff, U., and Mal, Suraj. (2016). *Climate Change, Glacier*

*Response and Vegetation Dynamics in the Himalaya.* Switzerland: Springer.

7. Trewartha G. T. (1980). *An Introduction to Climate.* NY, USA: McGraw Hill Company.

**Suggestive:**

1. Singh Savindra., (2015). *ParyawaranBhoogol (Hindi).* Allahabad, India: PrayagPushtakBhawan.
2. Singh, R.B., Prokop, Pawel., (Eds.) (2016). *Environmental Geography of South Asia.* Tokyo, Japan : Springer.
3. Sivaperuman, Chandrakasan. et al. (2018). *Biodiversity and Climate Change Adaptation in Tropical Islands.* London, UK: Academic Press.

**Teaching Learning Plan**

Week 1: Unit I

Week 2: Unit I

Week 3: Unit II

Week 4: Unit II

Week 5: Unit III

**Week 6: Mid-Semester Examinations**

**Week 7: Mid-Semester Break**

Week 8: Unit III

Week 9: Unit IV

Week 10: Unit IV

Week 11: Unit V

Week 12: Unit V

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**Ethnobotany  
(BHSE1)  
Skill-Enhancement Elective Course - (SEC) Credit:4**

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**Course Objective(2-3)**

To have the knowledge of the plants used by the local communities, tribals, ethnic groups, their nutritive and medicinal value.

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**Course Learning Outcomes**

Students would have an understanding of the treasure, value and usefulness of the the natural products and their efficient use by the local communities as food and medicine and their conservation practices .

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**Unit 1**

**Ethnobotany (6Lectures)**

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

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**Unit 2**

**Methodology of Ethnobotanical studies (6lectures)**

- a) Field work
  - b) Herbarium
  - c) Ancient Literature
  - d) Archaeological findings
  - e) temples and sacred places.
- 

**Unit 3**

Role of ethnobotany in modern Medicine (10 lectures) Medicoethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) Azadiractha indica b) Ocimum sanctum c) Vitex negundo. d) Gloriosa superba e) Tribulus terrestris f) Pongamia pinnata g) Cassia auriculata h) Indigofera tinctoria.

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#### Unit 4

Role of ethnobotany in modern medicine with special example of *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

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#### Unit 5

Ethnobotany and legal aspects (8 lectures) Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy,

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#### Unit 6

**Intellectual Property Rights and Traditional Knowledge.**

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#### Practical

Collection, identification and preparation of herbarium of three ethnobotanically important plants with appropriate references

Preparation of crude extract of ethnobotanically important plants with appropriate references (any method to be used)

Project work-documentation, literature survey, and collection of information on ethnobotanically useful plants from traditional healers)

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#### References

1. Colton, C.M. (1997). *Ethnobotany – Principles and applications*. Chichester, England: John Wiley and sons.
2. Faulks, P.J. (1958). *An Introduction to Ethnobotany*. London, U.K.: Moredale pub. Ltd.
3. Jain, S.K. (1995). *Manual of Ethnobotany*. Rajasthan: Scientific Publishers.
4. Jain, S.K. (1981). *Glimpses of Indian Ethnobotany*. New Delhi, Delhi: Oxford and I B H.

#### Additional Resources:

1. Jain, S.K. (1990). *Contributions of Indian Ethnobotany*. Jodhpur, Rajasthan: Scientific publishers.
2. Jain, S.K. (ed.) (1989). *Methods and approaches in Ethnobotany*. Lucknow, U.P.: Society of ethnobotanists.
3. Lone et al., *Palaeoethnobotany*.
4. Rama, R. N., Henry A.N. (1996). *The Ethnobotany of Eastern Ghats in Andhra Pradesh*. Howrah, West Bengal: Botanical Survey of India.

5. Sinha, R.K.(1996). *Ethnobotany The Renaissance of Traditional Herbal Medicine*. Jaipur, Rajasthan: SHREE Publishers.

### Teaching Learning Process

To engage students and transform them into active learners the students are updated with latest books and review articles.

The experiments included in the paper are performed individually or in group and are followed by group discussions and interjections

Week 1: Unit I

Week 2: Unit I

Week 3: Unit II

Week 4: Unit II

Week 5: Local Field Visits

Week 6: Unit II

Week 7: Unit III

Week 8: Unit IV

Week 9: Unit IV

Week 10: Mid semester Exam

Week 11: Mid Semester Break

Week 12: Unit V

Week 13: Local Institute Visit

Week 14: Unit VI

Week 15: Unit VI

### Assessment Methods

The students are assessed on the basis of oral presentations and regular class tests.

Students are continuously assessed during practical class.

Submission of class records is mandatory. This exercise develops scientific skill as well as methods of recording and presenting scientific data.

#### Assessment Task

Unit No	Course learning Outcome	Teaching and Learning Activity	Assessment Task
Unit I:	Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages	Activity :Class room lectures and Practical demonstration, experiments	Assessment: Hands on exercises, PPT, assignments, tests

	c) Resins and oils and miscellaneous uses		
Unit II:	Methodology of Ethnobotanical studies- Field work, Herbarium, Ancient Literature, Archaeological findings, temples and sacred places	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit III:	Medicoethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) <i>Azadiractha indica</i> b) <i>Ocimum sanctum</i> c) <i>Vitex negundo</i> . d) <i>Gloriosa superba</i> e) <i>Tribulus terrestris</i> f) <i>Pongamia pinnata</i> g) <i>Cassia auriculata</i> h) <i>Indigofera tinctoria</i> .	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit IV:	Role of ethnobotany in modern medicine with special example of <i>Rauvolfia serpentina</i> , <i>Trichopus zeylanicus</i> , <i>Artemisia</i> , <i>Withania</i> . Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit V:	Ethnobotany and legal aspects (8 lectures) Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy.	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit VI:	Intellectual Property Rights and Traditional Knowledge.	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests

### Keywords

Tribals, minor forest products, intoxicants, beverages, Resins, Field work, Herbarium, sacred groves, ethnobotanical practices, *Azadiractha indica*, *Ocimum sanctum*, *Vitex negundo*, *Gloriosa superba*, *Indigofera tinctoria*, ethnomedicines, conservation, Traditional Knowledge.

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**Course Code: CHEMISTRY –DSE-8****Course Title: Green Chemistry****Total Credits: 06****(Credits: Theory-04, Practical-02)****(Total Lectures: Theory- 60, Practical-60)**

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**Objectives:**

Today's society is moving towards becoming more and more environmentally conscious. There is rising concern of environmental pollution, depleting resources, climate change, ozone depletion, heaps and heaps of landfills piling up, legislation which is getting stringent with strict environmental laws, rising cost of waste deposits and so on. We are faced with a challenge to work towards sustainable practices. Green chemistry has arisen from these concerns. It is not a new branch of chemistry but the way chemistry should be practiced. Innovations and applications of green chemistry in education has helped companies not only gain environmental benefits but at the same time achieve economic and societal goals also. This is possible because these undergraduate students are ultimate scientific community of tomorrow.

**Learning Outcomes:**

By the end of this course, students will be able to:

- Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances.
- Understand stoichiometric calculations and relate them to green chemistry metrics. They will learn about atom economy and how it is different from percentage yield.
- Learn to design safer chemical products and processes that are less toxic, than current alternatives. Hence, they will understand the meaning of inherently safer design for accident prevention and the principle "what you don't have can't harm you"
- Understand benefits of use of catalyst and bio catalyst, use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources, importance led reactions in various green solvents.
- Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems. Thus the students are able to realise that chemistry can be used to solve rather than cause environmental problems.
- Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste. Success stories and real world cases also motivate them to practice green chemistry. These days customers are demanding to know about a product: Is it green? Does it contribute to global warming? Was it made from non depletable resources? Students have many career opportunities as "green" is the path to success.

### Unit 1:

#### Introduction to Green Chemistry

What is Green Chemistry? Some important environmental laws, pollution prevention Act of 1990, emergence of green chemistry, Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

(Lectures:5)

### Unit 2:

#### Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry and their explanation with examples

*Special emphasis on the following:*

- Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Environmental impact factor, waste or pollution prevention hierarchy
- Green metrics to assess greenness of a reaction, e.g. Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
- Prevention/ minimization of hazardous/ toxic products reducing toxicity
- Risk = (function) hazard x exposure
- Designing safer chemicals with minimum toxicity yet has the ability to perform the desired functions
- Green solvents: super critical fluids with special reference to carbon dioxide, water as a solvent for organic reactions, ionic liquids, fluoruous biphasic solvent, PEG, solventless processes, solvents obtained from renewable resources and how to compare greenness of solvents
- Energy requirements for reactions – alternative sources of energy: use of microwaves, ultrasonic energy and photochemical energy
- Selection of starting materials; should be renewable rather than depleting, illustrate with few examples such as biodiesel and polymers from renewable resources (such as green plastic)
- Avoidance of unnecessary derivatization – careful use of blocking/protecting groups
- Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.



- Design for degradation: A product should not persist after the commercial function is over e.g. soaps and detergents, pesticides and polymers
- Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.
- Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carbaryl) and Flixborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.

(Lectures:25)

### Unit 3:

#### Examples of Green Synthesis/ Reactions

- Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
- Green Reagents: Non-phosgene Isocyanate Synthesis, Selective Methylation using dimethylcarbonate.
- Microwave assisted solvent free synthesis of copper phthalocyanine
- Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid and Decarboxylation reaction
- Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)

(Lectures:10)

### Unit 4:

#### Real world case studies based on the Presidential green chemistry awards of EPA

- Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO<sub>2</sub> for precision cleaning and dry cleaning of garments.
- A new generation of environmentally advanced wood preservatives: Getting the chromium and Arsenic out of pressure treated wood.
- An efficient, green synthesis of a compostable and widely applicable plastic (polylactic acid) made from corn.
- Healthier Fats and oils by Green Chemistry: Enzymatic Inter esterification for production of No Trans-Fats and Oils.
- Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting.
- Using a naturally occurring protein to stimulate plant growth, improve crop quality, increase yields, and suppress disease.

(Lectures:10)

### Unit 5:

#### Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimcry and green chemistry, Biomimetic, Multifunctional Reagents; mechanochemical and solvent free synthesis of inorganic complexes; co crystal controlled solid state synthesis (C<sup>2</sup>S<sup>3</sup>); Green chemistry in sustainable development.

(Lectures:10)

## Practical:

(Credits: 2, Laboratory periods: 60)

### Chemistry Lab- Green chemistry

Characterization by m. pt., U.V.-Visible spectroscopy, IR spectroscopy, and any other specific method should be done (wherever applicable).

#### Safer starting materials

1. Preparation and characterization of nanoparticles of gold using tea leaves/silver nanoparticles using plant extracts.

#### Using renewable resources

2. Preparation of biodiesel from waste cooking oil and characterization (TLC, pH, Solubility, Combustion Test, Density, Viscosity, Gel Formation at Low Temperature and IR can be provided).

#### Use of enzymes as catalysts

3. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

#### Alternative green solvents

4. Extraction of D-limonene from orange peel using liquid CO<sub>2</sub> prepared from dry ice.
5. Mechanochemical solvent free, solid-solid synthesis of azomethine using p-toluidine and o-vanillin/p-vanillin (various other combinations of primary amine and aldehyde can also be tried).

#### Alternative sources of energy

6. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).
7. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

#### Reducing waste

8. Designing and conducting an experiment by utilizing the products and by products obtained in above preparations which become waste otherwise if not used. This is done by critical thinking and literature survey.

Some representative examples:

- Use of nanoparticles as catalyst for a reaction
- Benzoin converted into Benzil and Benzil into Benzilic acid by a green method
- Use of azomethine for complex formation
- Rearrangement reaction from Benzopinacol to Benzopinacolone
- Conversion of byproduct of biodiesel to a useful product
- Students should be taught to do spot tests for qualitative inorganic analysis for cations and anions, and qualitative organic analysis for preliminary test and functional group analysis.

## References:

**Keywords:**

Green chemistry, Twelve principles of green chemistry, Atom economy, Waste minimization, Green metric, Green solvents, Solvent free, Catalyst, Bio-catalyst, Renewable energy sources, Hazardous, Renewable feedstock, Ionic liquids, Supercritical fluids, Inherent safer design, Green synthesis, Co-crystal controlled solid state synthesis, Sustainable development, Presidential green chemistry awards.

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**Course Code: CHEMISTRY –DSE-9****Course Title: Industrial Chemicals and Environment****Total Credits: 06****(Credits: Theory-04, Practical-02)****(Total Lectures: Theory- 60, Practical-60)**

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**Objectives:**

The objective of this course is to make students aware about the concepts of different gases and their industrial production, uses, storage and hazards. Manufacturing, applications, analysis and hazards of the Inorganic Chemicals, Preparation of Ultra-Pure metals for semiconducting technology, Air and Water pollution, control measures for Air and Water Pollutants, Catalyst and Biocatalyst, Energy and Environment.

**Learning Outcomes:**

**By the end of this course students will be able to understand:**

- The different toxic gases and their toxicity hazards
- Safe design systems for large scale production of industrial gases.
- Manufacturing processes, handling and storage of inorganic chemicals.
- Hazardous effects of the inorganic chemicals on human beings and vegetation.
- The requirement of ultra-pure metals for the semiconducting technologies
- Composition of air, various air pollutants, effects and control measures of air pollutants.
- Different sources of water, water quality parameters, impacts of water pollution, water treatment.
- Different industrial effluents and their treatment methods.
- Different sources of energy.
- Generation of nuclear waste and its disposal.
- Use of biocatalyst in chemical industries.

**Unit 1:**

**Industrial Gases:** Large scale production, uses storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, and sulphur dioxide.

**(Lectures: 6)****Unit 2:**

**Inorganic Chemicals:** Manufacture, applications, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potassium dichromate and potassium permanganate

(Lectures: 10)

### Unit 3:

**Industrial Metallurgy:** Preparation of ultrapure metals for semiconductor technology.

(Lectures: 4)

### Unit 4:

**Environment and its segments:**

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere, chemical and photochemical reactions in atmosphere.

Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Major sources of air pollution, Pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases, methods of estimation of CO, NO<sub>x</sub>, SO<sub>x</sub> and control procedures, Effects of air pollution on living organisms and vegetation

Greenhouse effect and Global warming, Environmental effects of ozone, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and halogens, Air pollution control, Settling Chambers, Venturi Scrubbers, Cyclones, Electrostatic Precipitators (ESPs).

(Lectures:15)

### Unit 5:

**Water Pollution:**

Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological cycle and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro fertilizer.

Sludge disposal. Industrial waste management, incineration of waste.

Water treatment and purification (reverse osmosis, electro dialysis, ion exchange).

Water quality parameters for wastewater, industrial water and domestic water.

(Lectures:15)

### Unit 6:

**Energy & Environment:** Sources of energy: Coal, petrol and natural gas. Nuclear fusion / fission, solar, hydrogen, geothermal, tidal and hydel.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis: Introduction to biocatalysis: Importance in green chemistry and chemical industry.

(Lectures: 10)

## Practical:

(Credits: 2, Laboratory periods: 60)

### Chemistry Lab: Industrial Chemicals & Environment

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD).
3. Determination of Biological Oxygen Demand (BOD).
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO<sub>3</sub> and potassium chromate).
6. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
7. Measurement of dissolved CO<sub>2</sub>
8. Determination of hexavalent Chromium Cr(VI) concentration in tannery wastes/waste water sample using UV-Vis spectrophotometry technique.
9. Preparation of borax/ boric acid

## References:

### Theory

1. Manahan, S.E. (2017), **Environmental Chemistry**, CRC Press
2. Buchel, K.H.; Moretto, H.H.; Woditsch, P. (2003), **Industrial Inorganic Chemistry**, Wiley-VCH.
3. De, A.K. (2012), **Environmental Chemistry**, New Age International Pvt., Ltd.
4. Khopkar, S.M. (2010), **Environmental Pollution Analysis**, New Age International Publisher.

### Practical

1. Vowles, P.D.; Connell, D.W. (1980), **Experiments in Environmental Chemistry: A Laboratory Manual**, Vol.4, Pergamon Series in Environmental Science.
2. Gopalan, R.; Anand, A.; Sugumar R.W. (2008), **A Laboratory Manual for Environmental Chemistry**, I. K. International.

B.Com (Hons.) CBCS

Department of Commerce, University of Delhi, Delhi

**B.Com. (Hons.): Semester - VI**  
**Paper BCH 6.1- AUDITING AND CORPORATE GOVERNANCE**

**Duration: 3 hrs.****Objective:** To provide knowledge of auditing principles, procedures and techniques in accordance with current legal requirements and professional standards.**Unit I: Auditing**

Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure – Vouching and verification of Assets & Liabilities;

Company Auditor- Qualifications and disqualifications; Appointment, Rotation, Removal, Remuneration, Rights and Duties; Auditor's Report- Contents and Types, Liabilities of Statutory Auditors under the Companies Act 2013

Special Areas of Audit: Cost audit, Tax audit and Management audit; Recent Trends in Auditing: Basic considerations of audit in EDP Environment; Relevant Auditing and Assurance Standards (AASs).

**Unit II: Corporate Governance**

Meaning, Theories, Models and Benefits of Corporate Governance; Politics and Governance; Board Committees and their Functions; Insider Trading; Rating Agencies; Green Governance/ E-governance; Clause 49 of Listing Agreement; Corporate Governance in Public Sector Undertakings; Corporate Funding of Political Parties; Class Action; Whistle Blowing; Shareholders Activism.

**Unit III: Major Corporate Governance Failures**

BCCI (UK), Maxwell Communication (UK), Enron (USA), World.Com (USA), Andersen Worldwide (USA), Vivendi (France), Harshad Mehta Scam, Satyam Computer Services Ltd, and Kingfisher Airlines; Common Governance Problems Noticed in various Corporate Failures; Codes and Standards on Corporate Governance; Initiatives in India.

**Unit IV: Business Ethics**

Morality and Ethics; Business Values and Ethics; Various Approaches to Business Ethics; Ethical Theories; Ethical Governance; Corporate Ethics; CSR – Extension Of Business Ethics; Benefits of Adopting Ethics in Business; Ethics Programme; Code of Ethics; Ethics Committee

**Unit V: Corporate Social Responsibility (CSR)**

Corporate Philanthropy, Meaning of CSR, CSR and CR, CSR and Corporate Sustainability, CSR and Business Ethics, CSR and Corporate Governance, Environmental Aspect of CSR, CSR provision under the Companies Act 2013, CSR Committees, CSR Models, Drivers of CSR, Codes and Standards on CSR, Global Reporting Initiatives, ISO 26000



**B.Com. (Hons.): Semester - III**  
**Paper BCH 3.1: HUMAN RESOURCE MANAGEMENT**

**Duration:** 3 hrs.

**Objective:** To acquaint students with the techniques and principles to manage human resource of an organisation.

**Unit I: Human Resource Management**

Concept and functions; Role, status and competencies of HR manager; HR policies; Evolution of HRM; Emerging challenges of human resource management - Workforce diversity, empowerment, downsizing, VRS, work life balance.

**Unit II: Acquisition of Human Resource**

Human resource planning- Quantitative and qualitative dimensions; Job analysis – Job description and job specification; Recruitment – concept and sources; Selection – concept and process; Test and interview; Placement, induction and socialization; Retention.

**Unit III: Training and Development**

Concept and importance; Role specific and competency based training; Training and development methods – Apprenticeship, understudy, job rotation, vestibule training, case study, role playing, sensitivity training, In-basket, management games, conferences and seminars, coaching and mentoring, management development programs; Training process outsourcing.

**Unit IV: Performance Appraisal and Compensation Management**

Performance appraisal- Nature, objectives and process; Performance management; Methods of performance appraisal; Potential appraisal; Employee counselling; Job changes - Transfers and promotions, Human resource audit;  
Compensation - Concept and policies, Base and supplementary compensation; Individual, group and organization incentive plans; Fringe benefits; Performance linked compensation; Employee stock option; Pay band compensation system; Job evaluation.

**Unit V: Maintenance of employees and Emerging Horizons of HRM**

Employee health and safety; Employee welfare; Social security (excluding legal provisions); Employer-employee relations- An overview; Grievance handling and redressal; Industrial disputes: Causes and settlement machinery; e-HRM; Human Resource Information System and e-HRM; Impact of HRM practices on organisational performance; HR audit, Contemporary issues in human resource management.

**Suggested Readings**

1. Mondy, A. W., and Noe, R. M. *Human Resource Management*. Pearson Education.
2. Decenzo, D.A., and Robbins, S. P. *Fundamentals of Human Resource Management*. Wiley, India.
3. Dessler, G., and Varkkey, B. *Human Resource Management*. Pearson Education, Delhi.

**B.Com.: Semester V**  
**Paper BC 5.1 (a): Human Resource Management**

**Duration: 3 hrs.**

**Objective:** The objective of the course is to acquaint students with the techniques and principles to manage human resource of an organisation.

**Contents**

**Unit I: Introduction**

Concept and functions; Role, status and competencies of HR manager; Organization of HR Department; HR Policies; Evolution of HRM; Emerging challenges of human resource management like workforce diversity, downsizing, work life balance, etc.

**Unit II: Acquisition of Human Resource**

Human resource planning; Job analysis – job description and job specification; Recruitment – Concept and sources; Selection – Concept and process; Testing and interview; Placement and induction.

**Unit III: Training and Development**

Concept and importance; Identifying training and development needs; Designing training programmes; Training and development methods – Apprenticeship, understudy, job rotation, vestibule training, case study, role playing, sensitivity training, In-basket, management games, coaching and mentoring, management development programs; Evaluating training effectiveness.

**Unit IV: Performance Appraisal**

Nature and objectives; Performance appraisal process; Methods of performance appraisal; Job changes - transfers and promotions; Potential appraisal.

**Unit V: Compensation and Maintenance of employees**

Compensation - Concept and policies; Job evaluation; Methods of wage payments and incentive plans; Fringe benefits; Performance linked compensation; Employee health and safety; Employee welfare; Social security (excluding legal provisions); Grievance handling and redressal.

**Suggested Readings:**

1. Decenzo, D.A. and Robbins, S. P. *Fundamentals of Human Resource Management*. India: Wiley.
2. Dessler, G. and Varkkey, B. *Human Resource Management*. Delhi: Pearson Education.
3. Chhabra, T.N. *Human Resource Management*. Delhi: Dhanpat Rai & Co.
4. Aswathappa K. *Human Resource Management*. New Delhi: Tata McGraw-Hill.
5. Gupta, C.B. *Human Resource Management*. Delhi: Sultan Chand & Sons.
6. Rao, V. S. P. *Human Resource Management: Text and Cases*. Excel Books.

**Note:** Latest edition of text books may be used.



**Skill Enhancement Course  
Intellectual Property Rights  
(Credits 2)  
Lectures: 30**

- Unit 1: Introduction to intellectual property right (IPR)** (2 lectures)  
Concept and kinds. Economic importance. IPR in India and world: Genesis and scope, some important examples. IPR and WTO (TRIPS, WIPO).
- Unit 2 : Patents** (3 Lectures)  
Objectives, Rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Working of patents. Infringement.
- Unit 3: Copyrights** (3 Lectures)  
Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement.
- Unit4: Trademarks** (3 Lectures)  
Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defences, Domain name.
- Unit 5: Geographical Indications** (3 Lectures)  
Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position.
- Unit 6: Protection of Traditional Knowledge** (4 Lectures)  
Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability, need for a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library.
- Unit 7: Industrial Designs** (2 Lectures)  
Objectives, Rights, Assignments, Infringements, Defences of Design Infringement
- Unit 8: Protection of Plant Varieties** (2 Lectures)  
Plant Varieties Protection-Objectives, Justification, International Position, Plant varieties protection in India. Rights of farmers, Breeders and Researchers. National gene bank, Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.
- Unit 9: Information Technology Related Intellectual Property Rights** (4 Lectures)  
Computer Software and Intellectual Property, Database and Data Protection, Protection of Semi-conductor chips, Domain Name Protection
- Unit 10: Biotechnology and Intellectual Property Rights.** (4 Lectures)  
Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues

Attested by the Principal,  
Shivaji College (University of Delhi)

*Shivaji* *Satdew*  
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