

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

- A.** The college organized several events on environment, gender, human values and rights, such as:
- i. **Observance of Human Rights Day (10th Dec, 2021)** - A programme on Human Rights Day was organized by the NSS Unit of our College. Our Principal, Dr. Mausumi Singh (Sengupta) delivered a speech covering all the aspects of the basic Human Rights and the importance of Personality Development among the students. NSS volunteers and students from different departments gave small presentations on the said topic.
 - ii. **Observation of National Energy Conservation Day (14th Dec, 2021)** – A small programme was organized by the NSS Unit of our College. The Program Officer gave a speech followed by power point and poster presentations. Winners were handed over prizes and certificates.
 - iii. The department of Botany inaugurated ‘**Green Manure Production Unit**’ (having three pits) on **16th Dec, 2021**. The guest Speaker was Dr. Samir Ranjan Sikdar, Retired Professor from Bose Institute. Of the three pits, the first pit was filled up with dry leaves and kitchen waste (collected from canteen). Water was added and mixed with cow dung and molasses solution and was kept for expected final outcome.
 - iv. The College has a Women Cell which organizes events/program on gender and human values. The Cell has Principal as the chairperson and some female teachers as the members. In the current session, the Women Cell has organized a seminar on “**Economic Empowerment of women: Rising Trend of Female Entrepreneurs in India**” Day on **8th March 2022**. The speaker was **Dr. Sharmistha Banerjee** (Professor, Dept. of Business Management, University of Calcutta).
 - v. The department of Botany organized a special lecture and student seminar on ‘**Biodiversity Day**’ on **23rd May, 2022**. **Dr. Sauren Das**, Agricultural & Ecological Research Unit, Indian Statistical Institute, delivered a significant lecture on ‘Sunderbans: Adaptations of Mangrove Plants in the Saline Environment’. The students gave PowerPoint presentations and were judged by the guest speaker.
 - vi. The department of Zoology organized a webinar on “**Mountains, Mammals and more: Conservation, Research and Sustenance in a Himalayan Ecosystem**” on **5th June, 2021** as an observance of **World Environment Day**. The invited speaker was Dr. Ankita Bhattacharya (Research Associate, SACON).
- B.** A mandatory **Environmental Studies** Course was included in the Annual system (for final year students) and as in **Ability Enhancement Compulsory Course (AECC-2) in the Semester 2** of the CBCS curriculum (picture given below).
- C.** Different courses in the curriculum of both Hons. and General subjects has topics related to ethics, gender, human values, environmental sustainability etc. The details and the screenshots are given as follows:

- **Human Development (GE) in Semester 1 and 2**

**Syllabus for Choice Based Credit System Compliant Generic Elective Course in
Human Development**

Generic Elective can be regarded as Core Course in UG Programme (UG General)

Attendance: 10 marks per paper

Internal Assessment: 10 marks per paper

(CREDITS: THEORY – 4, PRACTICAL – 2)

SEMESTER - I

GE 1 A 50 Marks (Credits: 4) 2 Lectures / Week

INTRODUCTION TO HUMAN DEVELOPMENT

1. Human development and the need to study it; concept of human development index; roles of heredity and environment in human development; concepts of growth and development; the life span approach to human development.
2. Conception; physical and psychological care of the expectant mother; prenatal development.
3. Birth of the baby – the characteristics of the neonate; care of the neonate. Infancy – highlights of development ; caring for the infant – feeding, weaning , supplementary feeding ; sleep routine ; bathing and clothing ; immunization schedule ; importance of toys.
4. Highlights of development in childhood, adolescence, adulthood and old age.

References:

Arya, S.C. (1972). Infant and child care for the mother. New Delhi: Vikas.
Berk, L. E. (1996). Child development. New Delhi: Prentice Hall.
Hurlock, E.B. (2007). Developmental psychology: A life – span approach. New Delhi : Tata McGraw – Hill.
Nag, Rathindranath. Ma o shishu.
Papalia, D.E. , Olds, S.W. and Feldman, R.D. (2006). Human development. 9th Ed. New Delhi: Tata McGraw- Hill.
Roy, Sushil. Shiksha manavidya.

GE 1 B 30 Marks (Credits: 2) 2 Classes / Week

PRACTICAL: INTRODUCTION TO HUMAN DEVELOPMENT

1. Preparing a lay out of a room arranged for the birth of an infant showing the placement of the essential equipment.
2. Planning the diet of an expectant / a lactating mother; preparation of a diet chart.
3. Preparing a chart of prenatal / postnatal exercises for the mother.
4. Assessing and preparing charts on growth and physical development in infancy and childhood.
5. Preparing a lay out of the arrangement of a nursery (room designing and decoration).
6. Preparing picture / story books for infants and children.
7. Making play materials suitable for infants and children.

Practical Activities: 20 Marks; Viva- Voce: 5 Marks; Laboratory Note Book and materials: 5 Marks.

SEMESTER - II

GE 2A 50 Marks (Credits: 4) 2 Classes / Week

MARRIAGE AND FAMILY RELATIONS

1. Marriage – Definition, functions and changing trends. Marital adjustment and it's influencing factors.

- **Botany (Hons.) in Semester 6 (DSE paper)**

3. The art of imaging of samples through photomicrography and field photography
4. Poster/ power point presentation on defined topics
5. Technical writing on topics assigned.

Natural resource management (BOT-A-DSE-B-6-8-TH)

THEORETICAL
(Credits 4, Lectures 60)

Unit 1: Natural resources

Definition and types.

..... 2 lec

Unit 2: Sustainable utilization

Concept, approaches (economic, ecological and socio-cultural).

..... 8 lec

Unit 3: Land

Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

..... 8 lec

Unit 4: Water

Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetland Threats and management strategies.

..... 8 lec

Unit 5: Biological Resources

Biodiversity-definition and types; Significance; Threats; Management strate
Bioprospecting; IPR; CBD; National Biodiversity Action Plan).

..... 12 lec

Unit 6: Forests

Definition, Cover and its significance (with special reference to India); Major and minor Forest products; Depletion; Management.

..... 6 lec

Unit 7: Energy

Renewable and non-renewable sources of energy.

..... 6 lec

Unit 8: Contemporary practices in resource management

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

..... 8 lect

Unit 9: National and international efforts in resource management and conservation

..... 4 lect

PRACTICAL- Natural resource management (BOT-A-DSE-B-6-8-P)

(Credits 2)

1. Estimation of solid waste generated by a domestic system (biodegradable and non biodegradable) and its impact on land degradation.
2. Estimation of foliar dust deposition.
3. Determination of total solid in water (TDS)
4. Determination of chemical properties of soil by rapid spot test (carbonate, nitrate, etc.)

- Botany (Hons.) in Semester 4

SEMESTER IV
CORE COURSE-8
PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-TH)
THEORETICAL
(Credits 4, Lectures 60)

PLANT GEOGRAPHY

1. Phytogeographical regions:

1.1. Phytogeographical regions of India (Chatterjee 1960); 1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban.

.....8 lectures

2. Endemism:

2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora.

.....6 lectures

ECOLOGY

1. Preliminary idea on:

1.1. Habitat and Niche, 1.2. Ecotone and edge-effect, 1.3. Microclimate, 1.4. Ecads, ecotype and ecoclines, 1.5. Carrying capacity.

.....4 lectures

2. Community ecology:

2.1. Community- Characteristics and diversity, 2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.

.....6 lectures

3.1. Plant indicators (metallophytes); 3.2. Phytoremediation.

.....4 lectures

4. Conservation of Biodiversity:

4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity hot spots- criteria,

20

Indian hotspots, 4.3. *In-situ* and *ex-situ* conservation, 4.4. Seed-banks, 4.5. Cryopreservation

.....16 lectures

EVOLUTION

1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis

.....6 lectures

2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation

.....4 lectures

3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.

.....6 lectures

PRACTICAL- PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-P)
(Credits 2)

1. Workout on ecological parameters

2. Classroom performance: (Lab records)

3. Field Records (Field note book of phytogeographical study and ecological study)

4. Viva

PLANT GEOGRAPHY

1. Field visit- at least one long excursion at different phytogeographical region of India.

2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region.

ECOLOGY

1. Study of community structure by quadrat method and determination of (i) Minimum number of quadrats, (ii) Frequency, density and abundance of components (to be done during excursion field visit).



- English (Hons.) in Semester 5

CC11 (SEMESTER 5, CODE – ENG-A-CC-5-11-TH/TU)
WOMEN'S WRITINGS: 6 CREDITS

(5 CREDITS THEORY AND 1 CREDIT TUTORIAL)

Poetry

Emily Dickinson, 'I cannot live with you'
Elizabeth Barrett Browning, 'How do I love thee'
Eunice De Souza, 'Advice to Women'

Fiction

Alice Walker, *Color Purple* OR Emily Bronte, *Wuthering Heights*
Mahasweta Devi, 'Draupadi', translated Gayatri Chakravorty Spivak
Katherine Mansfield, 'Bliss'

Non-Fiction

Mary Wollstonecraft, *A Vindication of the Rights of Woman*, Chapters I & II (New York: Norton, 1988)

Rassundari Devi, *Amar Jiban*, translated Enakshi Chatterjee, Writers' Workshop.

End Semester Question Pattern:

Objective – 5 marks
One question of 15 marks from poetry (out of two)
Two questions of 15 marks each from fiction (out of three, one from each)
One question of 15 marks from non-fiction (out of two, one from each)

Suggested 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 Shiela 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.
5. 'Feminist Criticism' in Peter Barry, *Beginning Theory*, Chennai: T.R. Publications

- **English (Hons.) in Semester 5 (DSE paper)**

DSE-B2 (SEMESTER 5, CODE – ENG-A-DSE-B-5-2-TH/TU)
CONTEMPORARY INDIA: WOMEN AND EMPOWERMENT: 6 CREDITS

(5 CREDITS THEORY AND 1 CREDIT TUTORIAL)

Social Construction of Gender

History of Women's Movement in India (pre-independence and post-independence)

Women and Law: Domestic Violence, Female Foeticide, Sexual Harassment

Dalit Women and Double Marginalisation

End Semester Question Pattern:

Objective – 5 marks

Society, Sex and Gender – 20 marks

History of Women's Movement in India – 15 marks

Women and Law – 15 marks

Dalit Women – 10 marks

Recommended Readings:

1. Rinita Mazumdar, *A Short Introduction to Feminist Theory*, Kolkata: Anustup, 2010.
2. 'Feminist Criticism' in Peter Barry, *Beginning Theory*, Chennai: T.R. Publications, 1999.
3. V. Geetha, *Gender*, Calcutta: Stree, 2002.
4. Kate Millet, *Sexual Politics*, New York: Doubleday, 1970.
5. Ann Oakley, *Sex, Gender and Society*, London: Temple Smith, 1972.
6. Ray Raka, *Fields of Protest: Women's Movements in India*, New Delhi: Kali for Women, 2000.
7. *The Sexual Harassment of Women at Workplace, (Prevention, Prohibition and Redressal) Bare Act*, New Delhi: Universal, 2014.
8. Sharmila Rege, *Against the Madness of Manu, B.R. Ambedkar's Writings on Brahmanical Patriarchy*, New Delhi: Navayana, 2013.
9. Sandra Gilbert and Susan Gubar, *The Madwoman in the Attic: The Woman Writer and the Nineteenth Century Literary Imagination*

- English (Hons.) in Semester 3

CC3/GE3 (SEMESTER 3, CODE – ENG-G-CC-3-3-TH/TU) - 6 CREDITS
(5 CREDITS THEORY AND 1 CREDIT TUTORIAL)

WOMEN'S WRITING AND WOMEN'S EMPOWERMENT

Poetry

Elizabeth Barret Browning: 'How Do I Love Thee'
Christina Rossetti: 'Uphill'
Emily Dickinson: 'I cannot live with you'
Sarojini Naidu: 'Palanquin Bearers'

Prose

Rassundari Devi: *Amar Jiban*, translated Enakshi Chatterjee, Writers' Workshop.
Rokeya Sakhawat Hussain: *Sultana's Dream*

End Semester Question Pattern:

Objective – 5 marks
Two questions of 15 marks out of three from poetry
Two questions of 15 marks (one from each) out of four from prose (two from each)

- English (Hons.) in Semester 6 (DSE paper)

DSE-B3 (SEMESTER 6, CODE – ENG-A-DSE-B-6-3-TH/TU)
AUTOBIOGRAPHY - 6 CREDITS

(5 CREDITS THEORY AND 1 CREDIT TUTORIAL)

Rabindranath Tagore, *My Reminiscences*, Chapters 1-15, New Delhi: Rupa & Co.
Mahatma Gandhi, *Autobiography or the Story of My Experiments with Truth*, Part I, Chapters 1 to 8
Binodini Dasi, *My Story and Life as an Actress*, pp 61-83, New Delhi: Kali for Women
Nirad C. Chaudhuri, *Autobiography of an Unknown Indian*, Book I, Mumbai: Jaico Publishing House

End Semester Question Pattern:

Objective – 5 marks
One question of 15 marks out of two from each of the texts

Suggested Readings:

1. James Olney, 'A Theory of Autobiography' in *Metaphors of Self: The Meaning of Autobiography* (Princeton: Princeton University Press, 1972) pp. 3-50.
2. Laura Marcus, 'The Law of Genre' in *Auto/biographical Discourses* (Manchester: Manchester University Press, 1994) pp. 229-72.
3. Linda Anderson, 'Introduction' in *Autobiography* (London: Routledge, 2001) pp.1-17.
4. Mary G. Mason, 'The Other Voice: Autobiographies of women Writers' in *Life/Lines: Theorizing Women's Autobiography*, Edited by Bella Brodzki and Celeste Schenck (Ithaca: Cornell University Press, 1988) pp. 19-44.

- English (Hons.) –LCC paper

LCC (L2) – 1 (Alternative English)

LANGUAGE, SOCIETY AND PERSONALITY

(SEMESTER 4, CODE – ENG-G-LCC-2-4-1-TH/TU) - 6 CREDITS
(5 CREDITS THEORY AND 1 CREDIT TUTORIAL)

1. Language and Society:

- Shashi Tharoor, 'The Idea of India: India's Mosaic of Multiplicities'
- Ismat Chughtai, 'Roots'
- Ramachandra Guha, 'A Gandhian in Garhwal'

[from B. Keralavarma (ed), *Understanding India: Reflections on Indian Polity, Secularism and Sustainable Environment*, Kottayam, Kerala: Macmillan Publishers India Ltd and Mahatma Gandhi University, Kerala, 2010]

2. Language and Personality

- Louis Fischer, 'Gandhi and the Western World', from B. Keralavarma (ed), *Understanding India: Reflections on Indian Polity, Secularism and Sustainable Environment*, Kottayam, Kerala: Macmillan Publishers India Ltd and Mahatma Gandhi University, Kerala, 2010.
- Sisirkumar Ghosh, *Makers of Indian Literature: Rabindranath Tagore*, New Delhi: Sahitya Akademi, 2012 (first chapter, viz. 'Life')
- Subal Chandra Mitra, *Isvar Chandra Vidyasagar: A Story of His Life and Work*, New Delhi: Rupa and Co., 2008 (the first two chapters, viz. 'Birth and Ancestry' and 'Childhood and Early Instruction')

End Semester Question Pattern:

Objective – 5 marks

Two questions of 15 marks each out of three from Section 1.

Two questions of 15 marks each out of three from Section 2.

- Geography (Hons.) in Semester 4 (SEC paper)

HONOURS COURSE SKILL ENHANCEMENT SUBJECTS

4.4 GEO-A-SEC-B-4-04-TH – Sustainable Development ✧ 90 Marks / 2 Credits

- Sustainable development: Concept, historical background, components, and limitations [5]
- Challenges of sustainable development: Determinants, linkage among sustainable development, environment and poverty [10]
- Determinants of global environmental issues: Population, income distribution, urbanisation, deforestation, and depletion / contamination water resources [9]
- Global goals for sustainable development: Domain, conflict, crisis and compromise [6]

- Geography (Hons.) in Semester 6 (DSE paper)

3.7 **GEO-A-DSE-A-6-04-TH – Resource Geography** ✧ 60 Marks / 4 Credits

Unit I: Resource and Development

1. Natural resources: Concept and classification [4]
2. Approaches to resource utilization: Utilitarian, conservational, community based adaptive [6]
3. Significance of resources: Backbone of economic growth and development [5]
4. Pressure on resources. Appraisal and conservation of natural resources [5]
5. Problems of resource depletion: global scenario (forest, water, fossil fuels) [7]
6. Sustainable resource development [3]

Unit II: Resource Conflict and Management

7. Distribution, utilisation, problems and management of metallic mineral resources: Iron ore, bauxite, copper [6]
8. Distribution, utilisation, problems and management of non-metallic mineral resources: Limestone, mica, gypsum [6]
9. Distribution, utilisation, problems and management of energy resources: Conventional and non-conventional [6]
10. Contemporary energy crisis and future scenario [4]
11. Politics of power resources [3]
12. Limits to growth and sustainable use of resources. Concept of resource sharing [5]

- Environmental science (AECC2 paper)

University of Calcutta	
Under Graduate Curriculum under Choice Based Credit System (CBCS)	
Syllabus for Ability Enhancement Compulsory Course-2 (AECC-2) in	
Environmental Studies	
Semester-2	
Total Marks-100(Credit -2)	
(50 Theory-MCQ type + 30 Project + 10 Internal Assessment + 10 Attendance)	
[Marks obtained in this course will be taken to calculate SGPA & CGPA]	
Theory	
Unit 1 Introduction to environmental studies	2 lectures
<ul style="list-style-type: none"> •Multidisciplinary nature of environmental studies; •Scope and importance: Concept of sustainability and sustainable development. 	
Unit 2 Ecology and Ecosystems	6 lectures
<ul style="list-style-type: none"> •Concept of ecology and ecosystem, Structure and function of ecosystem; Energy flow in an ecosystem; food chains, food webs; Basic concept of population and community ecology; ecological succession. •Characteristic features of the following: <ol style="list-style-type: none"> a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, wetlands, rivers, oceans, estuaries) 	
Unit 3 Natural Resources	8 lectures
<ul style="list-style-type: none"> • Concept of Renewable and Non-renewable resources • Land resources and land use change; Land degradation, soil erosion and desertification. •Deforestation: Causes, consequences and remedial measures •Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). •Energy resources: Environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs. 	
Unit 4 Biodiversity and Conservation	8 lectures
<ul style="list-style-type: none"> •Levels of biological diversity: genetic, species and ecosystem diversity; •Biogeographic zones of India; 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. •Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. 	
Unit 5 Environmental Pollution	8 lectures
<ul style="list-style-type: none"> • Environmental pollution: concepts and types, • Air, water, soil, noise and marine pollution- causes, effects and controls • Concept of hazardous waste and human health risks • Solid waste management: Control measures of Municipal, biomedical and e-waste. 	
Unit 6 Environmental Policies and Practices	7 lectures
<ul style="list-style-type: none"> •Climate change, global warming, ozone layer depletion, acid rain and their impacts on human communities and agriculture •Environment Laws: Wildlife Protection Act; Forest Conservation Act, Water (Prevention and control of Pollution) Act; Air (Prevention & Control of Pollution) Act; Environment Protection Act; Biodiversity Act. •International agreements: Montreal Protocol, Kyoto protocol and climate negotiations; Convention on Biological Diversity (CBD). •Protected area network, tribal populations and rights, and human wildlife conflicts in Indian context. 	
Unit 7 Human Communities and the Environment	6 lectures
<ul style="list-style-type: none"> •Human population growth: Impacts on environment, human health and welfare. •Case studies on Resettlement and rehabilitation. • Environmental Disaster: Natural Disasters-floods, earthquake, cyclones, tsunami and landslides; Manmade Disaster- Bhopal and Chernobyl. •Environmental movements: Bishnois, Chipko, Silent valley, Big dam movements. •Environmental ethics: Role of gender and cultures in environmental conservation. •Environmental education and public awareness 	
Project/ Field work	Equal to 5 lectures
<ul style="list-style-type: none"> •Visit to an area to document environmental assets: Natural resources/Flora/Fauna, etc. •Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. •Study of common plants, insects, fish, birds, mammals and basic principles of identification. •Study of ecosystems-pond, river, wetland, forest, estuary and agro ecosystem. 	
Total	50 Lectures

Suggested Reading:

- Asthana, D. K. (2006). *Text Book of Environmental Studies*. S. Chand Publishing.
- Basu, M., Xavier, S. (2016). *Fundamentals of Environmental Studies*, Cambridge University Press, India
- Basu, R. N., (Ed.) (2000). *Environment*. University of Calcutta, Kolkata
- Bharucha, E. (2013). *Textbook of Environmental Studies for Undergraduate Courses*. Universities Press.
- De, A. K., (2006). *Environmental Chemistry*, 6th Edition, New Age International, New Delhi.
- Mahapatra, R., Jeevan, S.S., Das, S. (Eds) (2017). *Environment Reader for Universities*, Centre for Science and Environment, New Delhi.
- Masters, G. M., & Ela, W. P. (1991). *Introduction to environmental engineering and science*. Englewood Cliffs, NJ: Prentice Hall.
- Odum, E. P., Odum, H. T., & Andrews, J. (1971). *Fundamentals of ecology*. Philadelphia: Saunders.
- Sharma, P. D., & Sharma, P. D. (2005). *Ecology and environment*. Rastogi Publications.

- Microbiology (Hons.) in Semester 4

**B.Sc (HONOURS) MICROBIOLOGY (CBCS
STRUCTURE)
CC-9: ENVIRONMENTAL MICROBIOLOGY (THEORY)
SEMESTER -4**

MCB-A-CC-4-9-TH

TOTAL HOURS: 50

CREDITS: 4

Unit 1 Microorganisms and their Habitats

No. of Hours: 10

Structure and function of ecosystems

Terrestrial Environment: Soil profile and soil microflora

Aquatic Environment: Microflora of fresh water and marine habitats

Atmosphere: Aeromicroflora and dispersal of microbes

Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants)

Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hy.

& osmotic pressures, salinity, & low nutrient levels. Microbial

succession in decomposition of plant organic matter

25

Unit 2 Microbial Interactions

No. of Hours: 10

Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation

Microbe-Plant interaction: Symbiotic and non symbiotic interactions

Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic

luminescent bacteria

Unit 3 Biogeochemical Cycling

No. of Hours: 10

Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin

Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction

Phosphorus cycle: Phosphate immobilization and solubilisation

Sulphur cycle: Microbes involved in sulphur cycle

Other elemental cycles: Iron and manganese

Unit 4 Waste Management

No. of Hours: 10

Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill)

Liquid waste management: Composition and strength of sewage (BOD and COD), Primary,

secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and

tertiary sewage treatment

Unit 5 Microbial Bioremediation

No. of Hours: 5

Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and

inorganic (metals) matter, biosurfactants

Unit 6 Water Potability

No. of Hours: 5

Treatment and safety of drinking (potable) water, methods to detect potability of water samples:

(a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

**CC-9: ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)
SEMESTER -4
MCB-A-CC-4-9-P**

TOTAL HOURS: 60

CREDITS: 6

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C).
3. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
4. Assessment of microbiological quality of water.
5. Determination of BOD of waste water sample.
6. Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
7. Isolation of *Rhizobium* from root nodules.

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- Microbiology (Hons.) in Semester 5 (DSE paper)

B.Sc (HONOURS) MICROBIOLOGY (CBCS STRUCTURE)

DSE-B:

2. MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT (THEORY) SEMESTER –6

MCB-A-DSE-B-6-2-TH

TOTAL HOURS: 50

CREDITS: 4

Unit 1 Soil Microbiology

No of Hours: 6

Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil

Unit 2 Mineralization of Organic & Inorganic Matter in Soil

No of Hours: 6

Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium

Unit 3 Microbial Activity in Soil and Green House Gases

No of Hours: 5

Carbon dioxide, methane, nitrous oxide, nitric oxide – production and control

Unit 4 Microbial Control of Soil Borne Plant Pathogens

No of Hours: 7

Biocontrol mechanisms and ways, Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds

Unit 5 Biofertilization, Phytostimulation, Bioinsecticides

No of Hours: 12

Plant growth promoting bacteria, biofertilizers – symbiotic (*Bradyrhizobium*, *Rhizobium*, *Frankia*), Non Symbiotic (*Azospirillum*, *Azotobacter*, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs

Unit 6 Secondary Agriculture Biotechnology

No of Hours: 8

Biotech feed, Silage, Biomanure, biogas, biofuels – advantages and processing parameters

Unit 7 GM crops No of Hours: 6

Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals.

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DSE-B:

2.MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT (PRACTICAL) SEMESTER –6

MCB-A-DSE-B-6-2-P

TOTAL HOURS: 60

CREDITS: 2

1. Study soil profile
2. Study microflora of different types of soils
3. *Rhizobium* as soil inoculants characteristics and field application
4. *Azotobacter* soil inoculants characteristics and field application
5. Design and functioning of a biogas plant
6. Isolation of cellulose degrading organisms

SUGGESTED READINGS

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego.
2. Singh RS. (1998). Plant Diseases Management. 7th edition. Oxford & IBH, New Delhi.
3. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,

- Microbiology (Hons.) in Semester 4 (SEC paper)

B.Sc (HONOURS) MICROBIOLOGY (CBCS STRUCTURE)
SEC-B:
2. MICROBIOLOGICAL ANALYSIS OF AIR AND WATER
SEMESTER – 4

MCB-A-SEC-B-4-2

TOTAL HOURS: 30

CREDITS: 2

Unit 1 Aeromicrobiology

No of Hours: 4

Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens

Unit 2 Air Sample Collection and Analysis

No of Hours: 7

Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi, Identification characteristics

Unit 3 Control Measures

No of Hours: 4

Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration

Unit 4 Water Microbiology

No of Hours: 4

Water borne pathogens, water borne diseases

Unit 5 Microbiological Analysis of Water

No of Hours: 7

Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

Unit 6 Control Measures

No of H 52

Precipitation, chemical disinfection, filtration, high temperature, UV light

Suggested Reading

- da Silva N, Taniwaki MH, Junqueira VC, Silveira N, Nascimento MS, Gomes RAR (2012) Microbiological Examination Methods of Food and Water A Laboratory Manual, CRC Press
- Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 1st edition. Benjamin/Cummings Science Publishing, USA
- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
- Hurst CJ, Crawford RL, Garland JL, Lipson DA (2007) Manual of Environmental Microbiology, 3rd edition, ASM press

- Microbiology (Hons.) in Semester 3 (SEC paper)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

B.Sc (HONOURS) MICROBIOLOGY (CBCS STRUCTURE)
SEC-A:
2. BIOFERTILIZERS AND BIOPESTICIDES
SEMESTER - 3

MCB-A-SEC-A-3-2

TOTAL HOURS: 30	CREDITS: 2
Unit 1 Biofertilizers	No of Hours: 10
General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.	
Symbiotic N ₂ fixers: <i>Rhizobium</i> - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants	
<i>Frankia</i> - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis Cyanobacteria, <i>Anabaena</i> - Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.	
Unit 2 Non - Symbiotic Nitrogen Fixers	No of Hours: 4
Free living <i>Aspergillus</i> , <i>Acetobacter</i> - free isolation, characteristics, mass inoculum, production and field application.	
Unit 3 Phosphate Solubilizers	No of Hours: 4
Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application	
Unit 4 Mycorrhizal Biofertilizers	No of Hours: 5
Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.	
Unit 5 Bioinsecticides	No of Hours: 7
General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, <i>Bacillus thuringiensis</i> , production, Field applications, Viruses - cultivation and field applications.	

- **Zoology (Hons.) in Semester 5**

3. Demonstration of ELISA

PART III: SEMESTER 5
CORE COURSE 11: Ecology
ZOOA-CC5-11-TH

Full Marks 50	4 Credits	50 Hours
Unit 1: Introduction to Ecology		4
Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.		
Unit 2: Population		20
Unitary and Modular populations Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors, Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition.		
Unit 3: Community		11
Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect; Ecological succession with one example.		

✓

Unit 4: Ecosystem	8
Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow, Ecological pyramids and Ecological efficiencies; Nitrogen cycle.	

✓

Unit 5: Applied Ecology	7
Types & level of biodiversity Mega-diversity countries, Biodiversity Hot spot, Flagship species, Keystone species, Wildlife Conservation (<i>in situ</i> and <i>ex situ</i> conservation), concept of protected areas. Red data book, Indian wild life act & Schedule. Concept of corridor, advantages and problem of corridor. Threats to survival and conservation strategies for Tiger, Olive ridley, White Rumped Vulture.	

Ecology Lab, ZOOA-CC5-11-P

Full Marks 30	60 Hours	2 Credits
List of Practical		
1. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community 2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO_2 3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden		

- **Journalism (Hons.) in Semester 5**

For Semester-5

JORA-DSE-A-5-2-TH+TU: Media, Human Rights, Gender, Environment Studies

Marks=100 (6 Credits)

Total Classes: TH: 5hrs + TU1hr. Per Week

Unit-1

Rights: inherent, inalienable, universal, indivisible; Values: Dignity, liberty, equality, justice, unity in diversity; Balance between Rights and Duties; Problems: Poverty, underdevelopment and illiteracy; Women, children and the disadvantaged groups;

Unit-2

Freedom and Responsibility, Freedom of Speech and Expression, Universal Declaration of Human Rights, National Human Rights Commission, State Human Rights Commissions, RTI, Right to Privacy.

Unit-3

Media exposure and Gender Construction, Media stereotypes in newspaper, Gender & Advertising, Indecent representation of women in media (Act), Masculinity and Femininity: Cultural Studies, Feminist movement and Media Studies;

Unit-4

Human Rights Institutions: Amnesty International; NGOs; Major Human Rights Issues in India; Presentation: Human Rights issues and violations in International scenario and media operations;

Readings:

1. UN Centre for Human Rights, Human Rights Training: A Manual on Human Rights Training Methodology (New York: UN, 2000).
2. UN Centre for Human Rights, Minority Rights (Geneva: World Campaign for Human Rights, 1998).
3. UNESCO, Human Rights of Women (Paris: UNESCO, 1999).
4. Basu, D.D., Human Rights in Constitutional Law (New Delhi: Prentice Hall, 1994).
5. Nagendra Singh, Enforcement of Human Rights (Calcutta: E L House, 1986).
6. UNESCO, Yearbook on Human Rights.

- **Political Science (General)-Semester 6 –DSE paper**

Human Rights: Theory and Indian Context Code: PLS-G-DSE-B-6-2B-TH+TU *Sem VI*

Module I

1. History of the idea of human rights; Evolution of generations of human rights.
- ✓ 2. Universal Declaration of Human Rights: provisions and significance.
- ③ 3. UN and human rights: charters; UN Human Rights Commission; Vienna Declaration and Programme of Action.

Module II

4. Indian Constitution and the foundation of rights.
- ⑤ 5. National and State Human Rights Commissions: structure and functions.
- ⑥ 6. Human rights in India: problems and remedies.

Readings:

Universal Declaration of Human Rights, www.un.org/en/udhrbook/pdf/udhr_booklet_en_web.pdf